HEALTHIER BUILDINGS
RETURNING FROM COVID-19

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CONTRIBUTORS

Donald K. Beck, Jr. AIA, NCARB
Partner-In-Charge, Beck Design

Paula Beck
Interiors Director, Beck Design

Casey Tarp AIA, NCARB, LEED AP
Managing Partner, Beck Design

Chris Pritchard AIA, NCARB, LEED AP
Senior Associate, Beck Design

Scott Ceasar, PE
Senior Vice President, Cosentini

Douglas Mass, PE
President, Cosentini
ACEC-NY Safety Committee

Edward Barbieri, PE
Executive Vice President, Cosentini

Michael Maybaum, PE
Executive Vice President, Cosentini

Vladimir Yarmarkovich, PE
Senior Vice President, Cosentini

Bud Spiewak, PE, AIA
Senior Vice President, Cosentini

Dominick DeRobertis, PE
Senior Vice President, Cosentini

Robert Leber, PE
Senior Vice President, Cosentini

Onorius Vaidean
Director of Information Technologies, Cosentini

Judi Kovacs, CIH, CPEA
Health & Safety Specialist, Tetra Tech

Steven Straus, PE
President, Glumac

Stuart Fowler
President, NDY

Dr. Michael Kaiser
M.D., F.A.A.P.

Dr. Bill Bahnfleth
Chairman - ASHRAE COVID-19 Taskforce

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DISCLAIMER

This presentation is provided to share knowledge and is based on current information at the time. The information presented should be thoroughly reviewed with respect to specific situations prior to implementation. Cosentini reserves the right to edit or change any and all information as needed based on changing information.

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CURRENT SITUATION

SARS-CoV2 is a contagious virus that causes the illness COVID-19 and is primarily transmitted through respiratory droplets (>5 microns). Other modes of transmission may include aerosols (<5 microns) and touching contaminated surfaces, although this is not thought to be the main way the virus spreads[1].

We need to re-think how we design buildings moving forward with a focus on healthy buildings

1. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html

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COVID-19 RESPONSE

- Awareness of SARS-CoV2 & COVID-19
- Operational Concepts
- Physical Environment Design Concepts
- Social Behaviors

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THE VIRUS

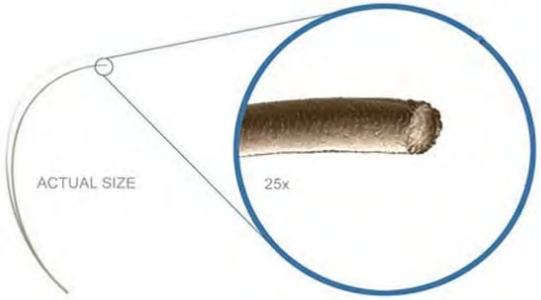
SARS-CoV2: Severe Acute Respiratory Syndrome Corona Virus 2

The illness caused by the virus is known as COVID-19

	SARS-CoV1	SARS-CoV2
Year of affect	2002-2004	2019-ongoing
Confirmed Cases	8,096	14,604,077*
Mortality Rate	9.50%	4.33%

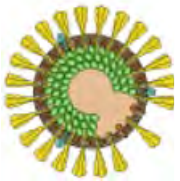
**as of 2020/07/21*

SARS-CoV2 is 60-140 nanometers in diameter



Human Hair
80,000 nm

AEROSOL



SARS-CoV2
60-140 nm

AEROSOL

Influenza
100 nm

AIRBORNE

Rhinovirus
30 nm

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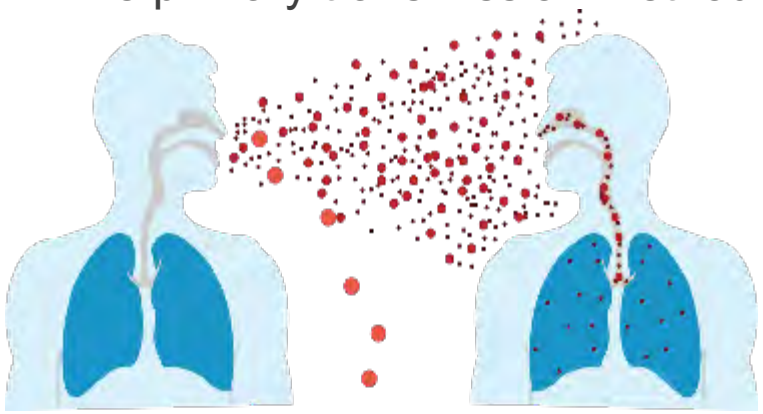
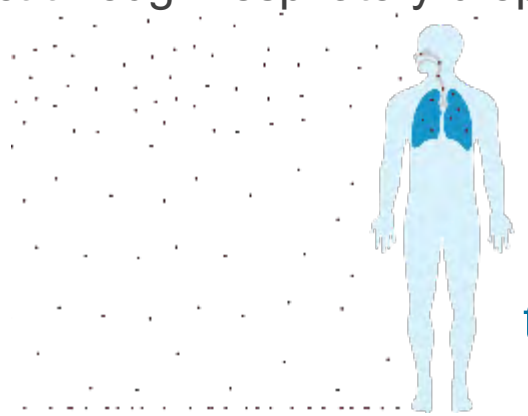
TRANSMISSION

The primary transmission method is from person-to-person in close contact through respiratory droplets.



Source: Kimberly A. Prather et al. Science 2020; DOI: 10.1126/science.abc6197

4 hours	1 day	3 days
Copper	Cardboard	Steel/Plastic



Virus found to live in the air for up to 3 hours

Source: N van Doremalen, et al. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. The New England Journal of Medicine DOI: 10.1056/NEJMc2004973

Respiratory droplets >5 microns

Coughs, sneezes, or exhales release droplets of infected fluid ɀ most fall quickly. If you are standing within 6ʏ of someone you can catch it by breathing in droplets.

Fomite Transmission

Touching contaminated surfaces or objects and then touching your eyes, nose or mouth.

Aerosolized Droplets <5 microns

Aerosolized droplets (droplet nuclei) can travel long distances through the air stream and linger, where they can be breathed in before eventually settling on surfaces. Most small particle losses are by exchange with outdoor air.

Sources: WHO: ɳModes of transmission of virus causing COVID-19: implications for IPC precaution recommendationsɔ
CDC: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html
CDC: ɳGeneration and Behavior of Airborne Particles (Aerosols)ɔ https://www.cdc.gov/niosh/topics/aerosols/pdfs/Aerosol_101.pdf
CDC: ɳAerosol and surface distribution of severe acute respiratory syndrome coronavirus 2 in hospital wards, Wuhan, China, 2020.ɔ https://doi.org/10.3201/eid2607.200885

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TRANSMISSION

There are 4 main elements to consider when identifying the risk of transmission.[1]

Distance

The closer you are to others the higher the risk. It is recommended by the CDC to stay at least 6ע apart.

Environment

A majority of infections (outside of nursing homes) occurred indoors, at home, in workplaces, on public transit, and during social gatherings. Reduce risks indoors with good ventilation.[2]

Time

The longer amount of time spent with others increases transmission risk. It is recommended to reduce sustained contact time to less than 15 minutes, especially if you are indoors.

Activity

Singing and yelling produce far more droplets than breathing, leading to an increased risk. Consider the activities happening around you to reduce risk.

1. *https://www.vox.com/science-and-health/2020/5/22/21265180/cdc-coronavirus-surfaces-social-distancing-guidelines-covid-19-risks*
2. *https://www.erinbromage.com/post/the-risks-know-them-avoid-them*

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TRANSMISSION

Pre-symptomatic spread: Those infected with the coronavirus are emitting the virus BEFORE they are symptomatic[1].

Asymptomatic spread: Those that are truly asymptomatic (never develop symptoms) appear to be a lower transmission risk[1].

2.5 days

Time an infected individual is estimated to be spreading the virus before first symptoms appear

18 hours

Time before developing first symptoms at which an infected person is estimated to be most contagious

44%

Estimation of transmissions that may occur during the pre-symptomatic period

Symptoms may appear 2-14 days after exposure to the virus[2].

1. *He, X., Lau, E.H.Y., Wu, P. et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. Nat Med 26, 672ɤ675 (2020). https://doi.org/10.1038/s41591-020-0869-5*
2. *https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html*

TRANSMISSION

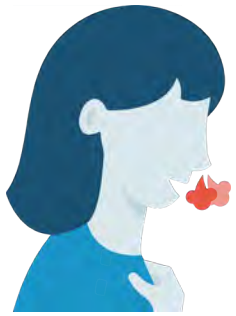
The infectious dose (the amount of virus necessary to make someone sick) of SARS-CoV2 is currently unknown. Experts speculate it ranges from a few hundred to thousands of infectious particles[1].

Lower infectivity, Needs more sustained contact time to infect

Higher Infectivity, Needs less sustained contact time to infect

Less droplets
Average droplet size is smaller
Most droplets don't come from lower respiratory area

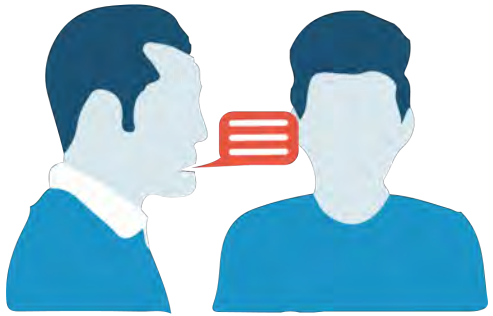
More Droplets
Average droplet size is larger
Many droplets come from lower respiratory area



Breathing

50-5,000 Droplets[2]

~33 infectious particles per minute for influenza, unknown for SARS-CoV2



Speaking

600-2,600 Droplets[2 3]

~200-1,000 infectious droplets per minute & can stay in the air for 8-14 minutes

Coughing

3,000 Droplets[2]

~millions of infectious particles, travels at 50 mph, and can stay in the air for 30 minutes or more

Sneezing

40,000 Droplets[2]

~millions of infectious particles, travels at 200 mph, and can stay in the air for 30 minutes or more

1. https://www.sciencemediacentre.org/expert-reaction-to-questions-about-covid-19-and-viral-load/
2. https://www.erinbromage.com/post/the-risks-know-them-avoid-them
3. Valentyn Stadnytskyi, Christina E. Bax, Adriaan Bax, and Philip Anfinrud "The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission" PNAS first published May 13, 2020 https://doi.org/10.1073/pnas.2006874117

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HEALTHIER BUILDINGS RETURNING FROM COVID-19

Recommendations for healthier buildings

Architectural

Space planning for distancing

Frictionless entryways

Lighting Controls & Automated Shading

Distance Indicator on Floors

Larger workstations

Material

Low-VOC materials

Easy to clean surfaces

Anti-microbial applications

HVAC

Improve air quality: Increase air exchange rates & High-efficiency filtration/air treatment

Ensure pressurization between spaces

Humidification

Decentralized Systems

Technology

High-tech connectivity

App-based touch-free systems

Smart Concierge

Thermal Scanning

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ARCHITECTURAL || DE-DENSIFICATION

- One-Way Entry / Exits
- Lighting Controls & Automated Shading
- Frictionless Entryways
- Appropriate Signage (graphics for visual social-distancing guides and reminders)
- Space Planning for Distancing
- Modular Furniture (adjusting to any space and situation)

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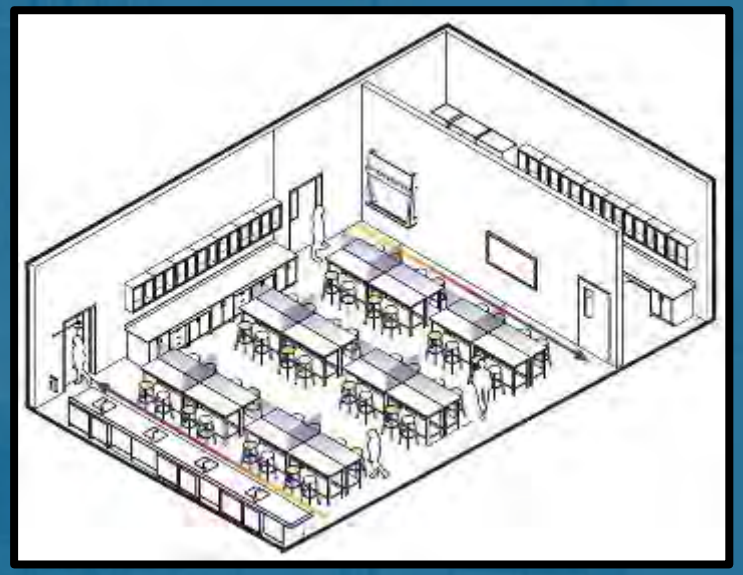
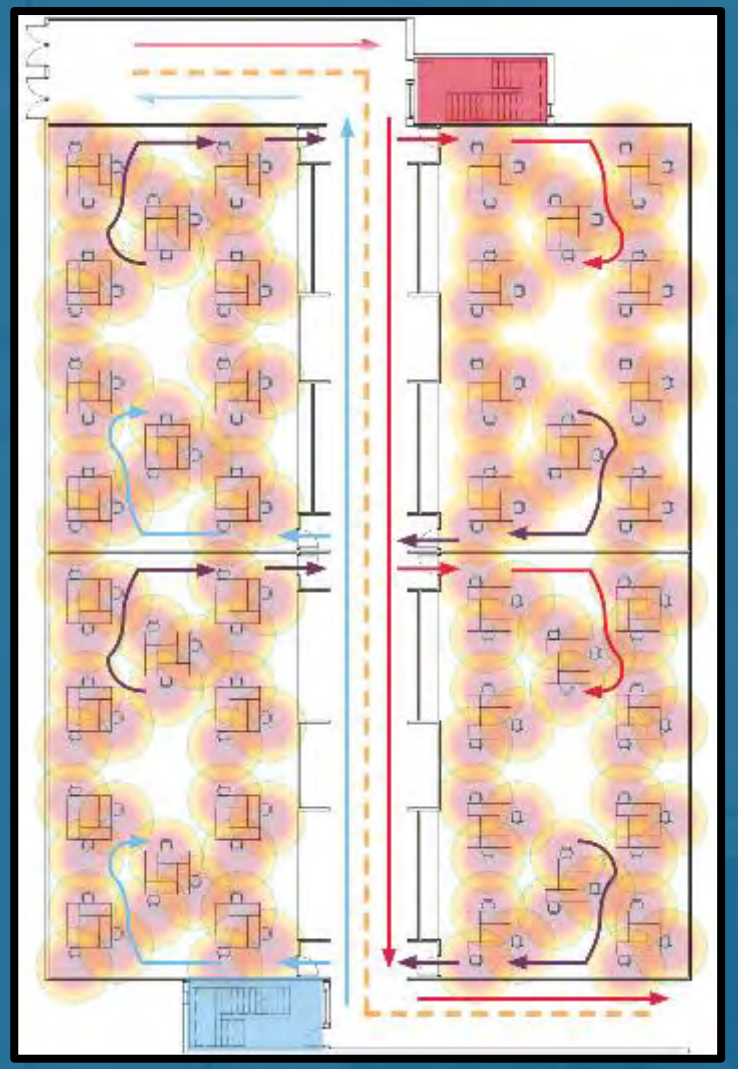
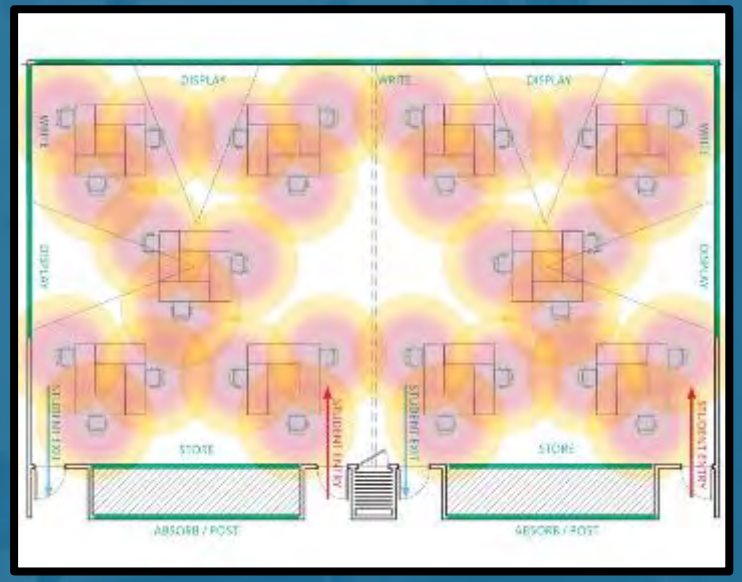
ARCHITECTURAL || DE-DENSIFICATION

- One-Way Entry / Exit
- Space Modifications







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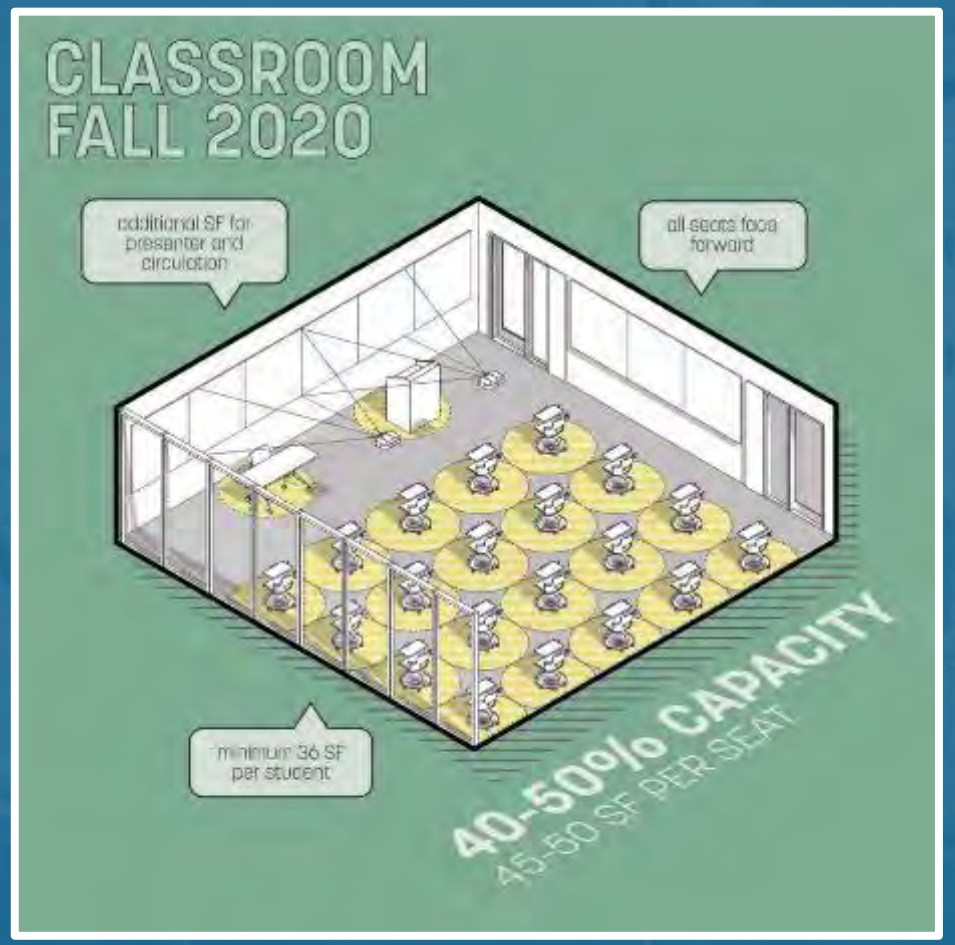
ARCHITECTURAL || DE-DENSIFICATION

- Classrooms at 40% - **50%** Capacity



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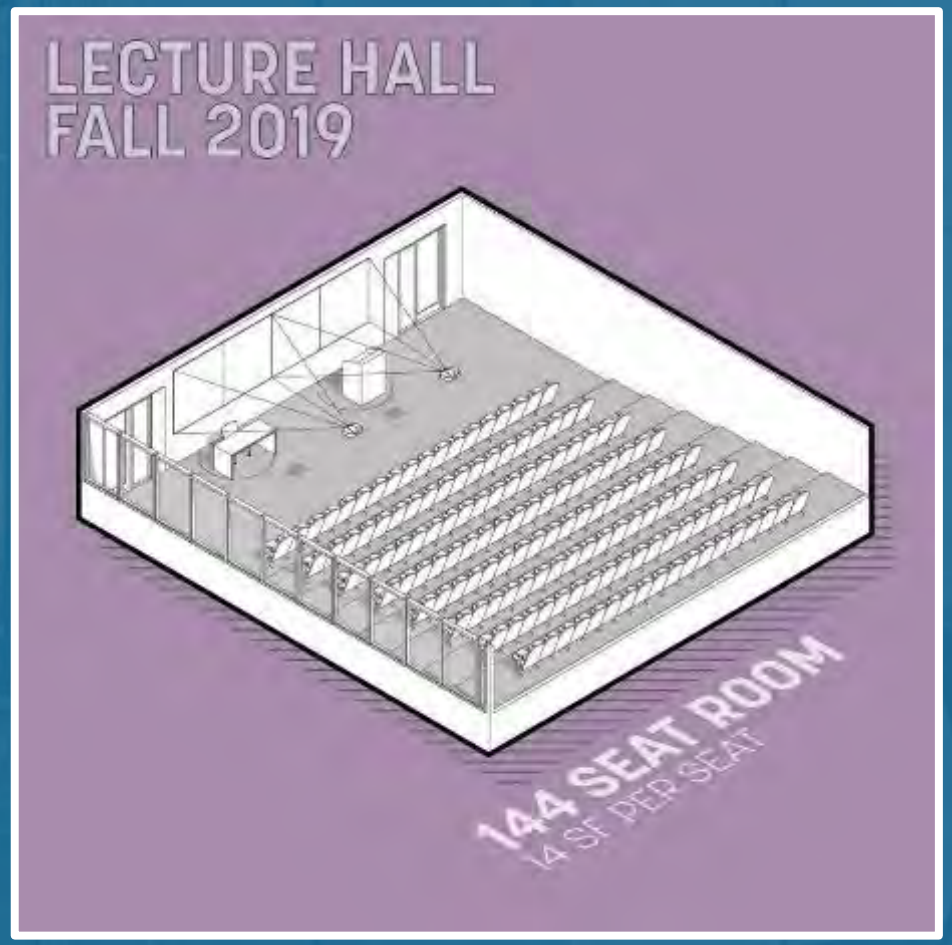
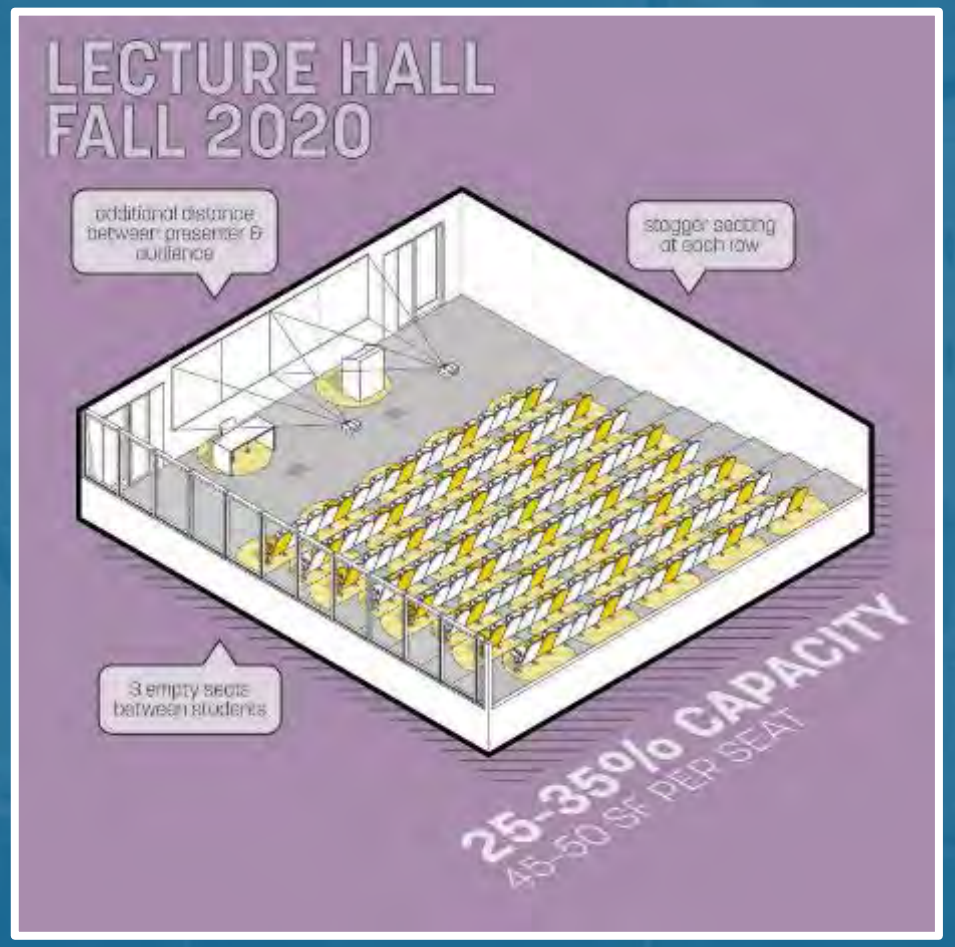
ARCHITECTURAL || DE-DENSIFICATION





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ARCHITECTURAL || DE-DENSIFICATION

- Space Planning for De-densification on Campus
- Outdoor Classrooms & Green Space (not a new phenomenon!)

Outdoor classroom facilities. Chicago, US, 1911, (left); Paris, France, 1935 (right)

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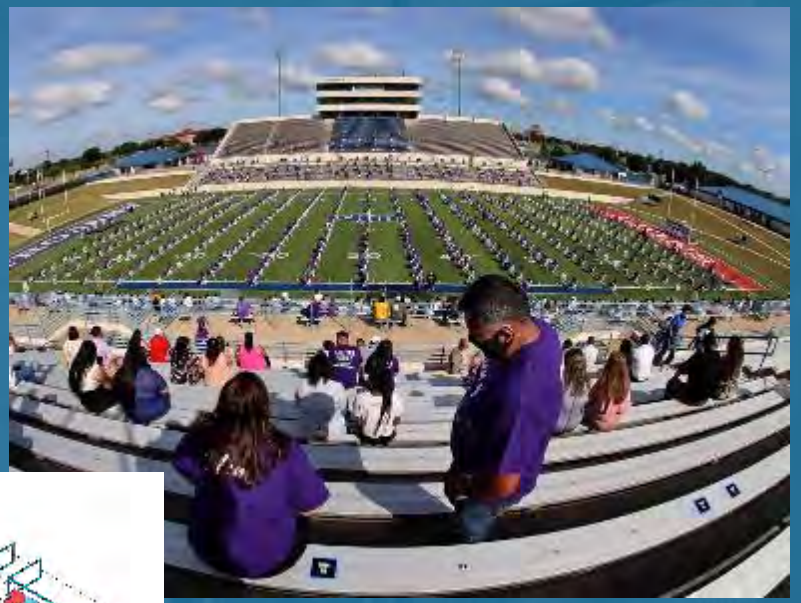
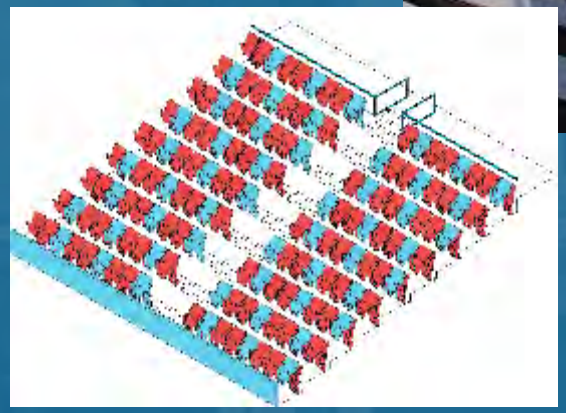
ARCHITECTURAL || DE-DENSIFICATION

Distancing Solutions at Large Gatherings





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MATERIALS || HEALTHY FINISHES

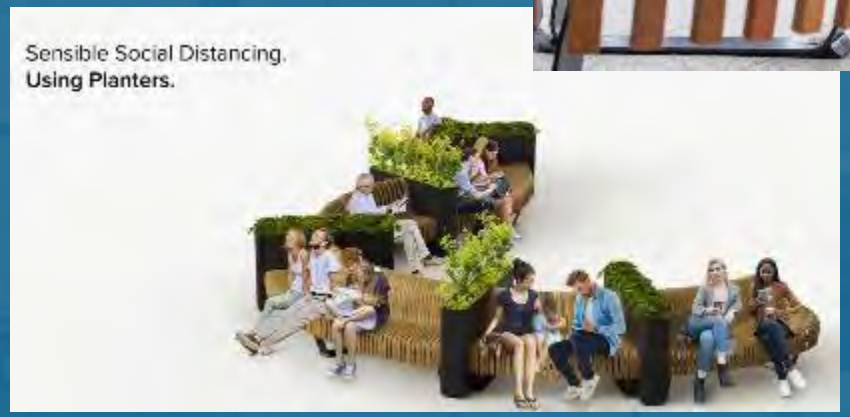
Necessity of Antimicrobial Finishes?

- avoid cross infection by pathogenic micro-organisms
- control the infestation by microbes
- arrest metabolism in microbes in order to reduce the formation of odor
- safeguard the textile products from staining, discoloration, and quality deterioration
- deterioration

MATERIALS || HEALTHY FINISHES

Why Are Natural Wood Materials Healthier?

- natural antibacterial and antimicrobial properties which eliminate potential contaminants
- dries quickly putting bacteria at a disadvantage



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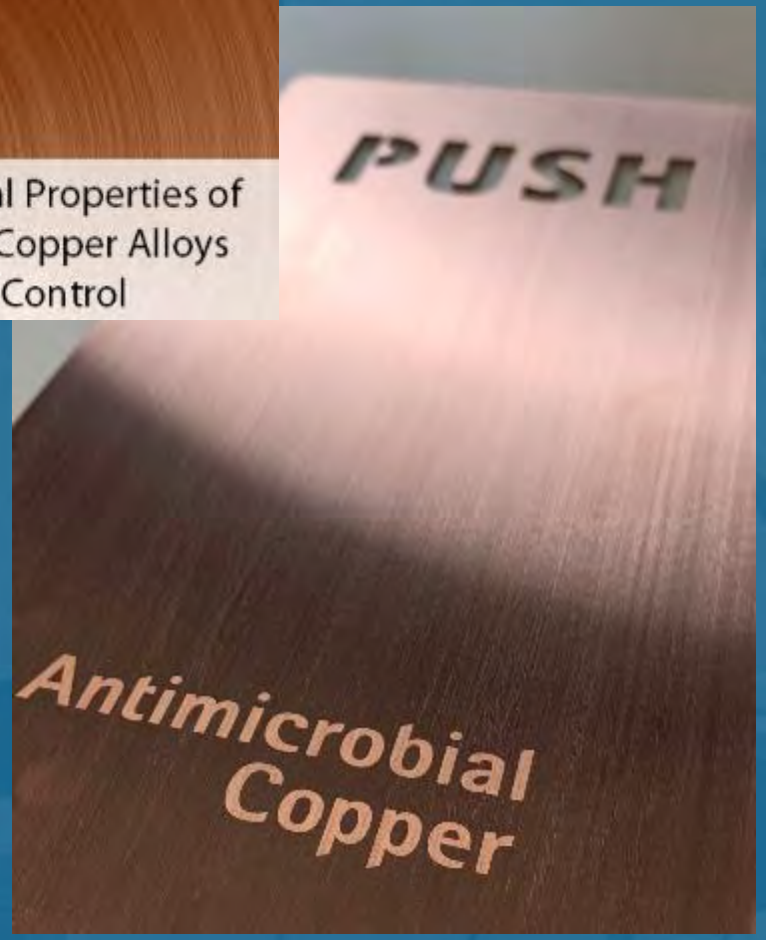
MATERIALS || HEALTHY FINISHES



Copper Antimicrobial Laminate

How it Works:

- **Surface with the shortest life-span for bacteria.**
- Copper ion penetrates bacteria, so the cell loses significant nutrients and water.
- Bacteria gets serious prevention for respiratory and metabolic activity, which leads to complete extinction.

Excellent use on covering items such as:

- Any knobs, buttons, handles, equipment in high traffic areas

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HVAC || ENHANCED HVAC SYSTEMS

Air Quality
(Dilutes Contaminants)

Increase outdoor air ventilation

Disable demand-controlled ventilation

Extend hours of operation and consider pre/post occupancy purge ventilation

Provide CO2 sensors in densely occupied spaces

Air Treatment
(Removes/Disables Contaminants)

Enhanced Filtration (MERV 14+)

Air Ionization (Bi-Polar Ionization / Photo-Hydro Ionization)

UV Light Sanitizers (Ultraviolet Germicidal Irradiation & Photo Catalytic Oxidation)

Air Exchange

Reduce air recirculation with smaller HVAC zones

Increase bathroom exhaust and elevator ventilation

Control pressurization relationships

Humidification

Control humidification within optimal bandwidth

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ASHRAE'S POSITION

"Because it is sufficiently likely that SARS-CoV-2 can be transmitted through the air, airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures.

Ventilation and filtration provided by heating, ventilating, and air-conditioning systems can reduce the airborne concentration of SARS-CoV-2 and thus the risk of transmission through the air."

Source: ASHRAE's statement on airborne transmission of SARS-CoV-2/COVID-19

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INCREASING AIR QUANTITY (ACH)

Increase outdoor air change to dilute contaminants in the air.

Air Changes Per Hour (ACH)

Assuming 9’ ceiling and 1 CFM/sf	Typical Modern Building			Typical 1970’s Induction Building		
		Outside ACH	Filtered Recirculation ACH		Outside ACH	Filtered Recirculation ACH
Outside air	.15 CFM/sf			.25 CFM/sf		
Time for 100% outside air change	60 minutes	1	6	36 minutes	1.7	6
If % outside air is doubled	30 minutes	2	6	18 minutes	3.3	6
Assuming 12’ ceiling and 1 CFM/sf	**Typical Modern Building**			**Typical 1970’s Induction Building**		
Time for 100% outside air change	80 minutes	.75	4.5	48 minutes	1.25	4.5
If % outside air is doubled	40 minutes	1.5	4.5	24 minutes	2.5	4.5

Implications of HVAC Energy Usage

Code outside air without demand controlled ventilation +5% energy usage

Doubling the ventilation without demand controlled ventilation +20% energy usage

**These numbers are for a floor by floor VAV system.*

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AIR TREATMENT SYSTEMS

HEPA Filters

Bi-Polar Ionization

UV Light Sanitizers

Carbon Filters

Due to the nature of the SARS-CoV2 virus, HVAC solutions are not effective in preventing the spread of contamination person to person or eliminating airborne transmission risk, however the following technologies are presented because they provide benefit in bacterial and virus reduction within their path of effect. The highest performance treatment systems can remove up to 99.99% of viruses.

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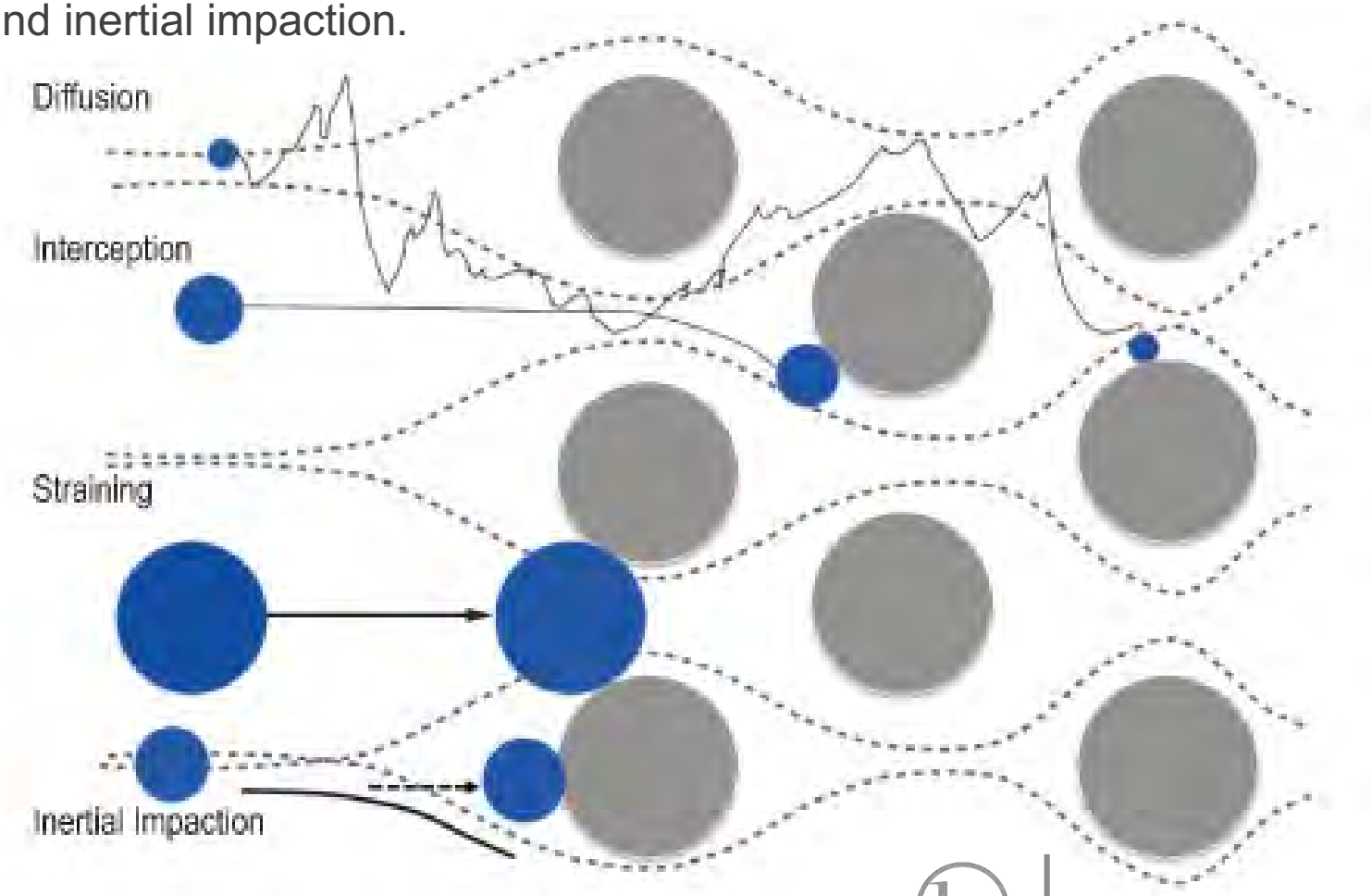
HVAC || AIR TREATMENT - HEPA FILTERS

HEPA filters consist of interlaced glass fibers that create a fibrous maze that takes particles out of circulation through diffusion, interception, straining, and inertial impaction.

HEPA Filters*

When selecting a filter, careful consideration must be given due to the pressure drop from a high filter



In large central stations consider electronic filter (performs at MERV 15 level)

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AIR TREATMENT ɀ FILTRATION

MERV - Minimum Efficiency Reporting Value

HEPA - High Efficiency Particulate Air filter

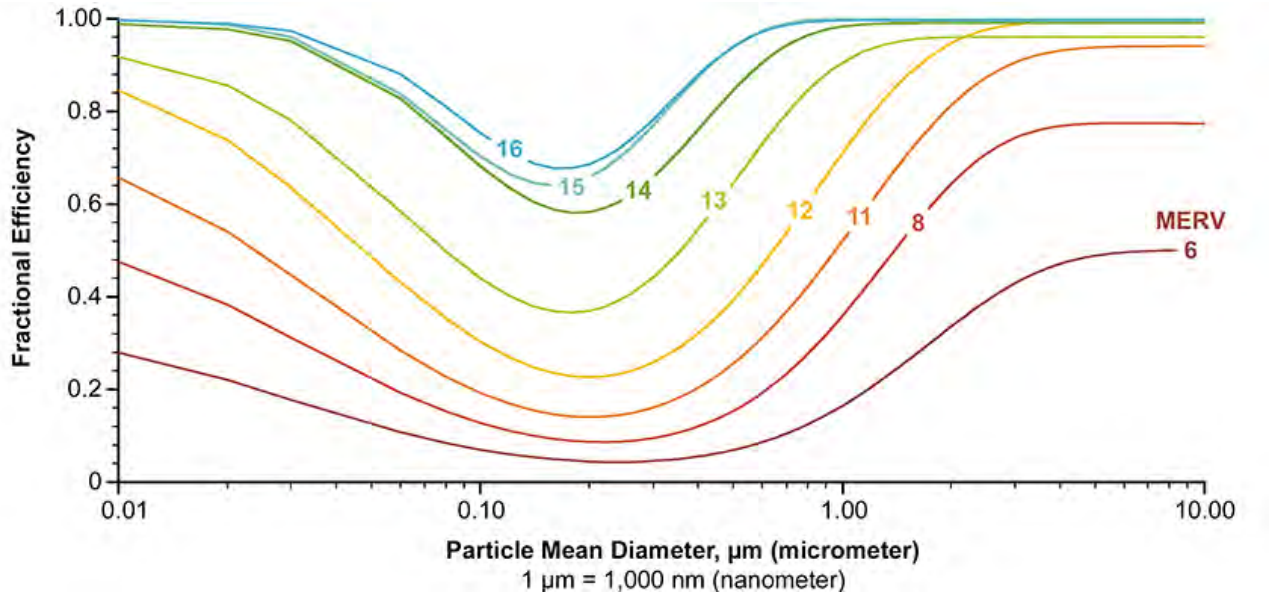
Ratings	0.3-1 microns*	1-3 microns	3-10 microns	Filter Type	Controlled Particles
MERV 8	-	-	70-85%	Low Quality MERV Filter	Mold spores, pollen, dust
MERV 9	-	<50%	85-90%	Standard MERV Filter	Fine dust
MERV 11	-	65-79%	85-90%		
MERV 13	<75%	<90%	<90%	Superior MERV Filter	Bacteria, viruses, smoke
MERV 14	75-84%	<90%	<90%		
MERV 15	85-94%	<90%	<90%		
MERV 16	<95%	<95%	<95%		
MERV 17	99.97%	<99%	<99%	HEPA / ULPA Filter	Small bacteria and viruses, fumes
MERV 18	99.997%	<99%	<99%		
MERV 19	99.9997%	<99%	<99%		
MERV 20	99.99997%	<99%	<99%		

Filters must be changed regularly. Consider monitoring air quality as well.

AIR TREATMENT ɤ FILTRATION

Composite model of how filters perform for influenza virus filtration versus MERV

Fractional Efficiency of MERV Rate



Source: Kowalski and Bahnfleth (2002), MERV Filter Models for Aerobiological Applications.

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AIR TREATMENT ɤ FILTRATION

How filters perform for influenza virus and cost of filtration versus MERV

Infections Versus Filtration Rate

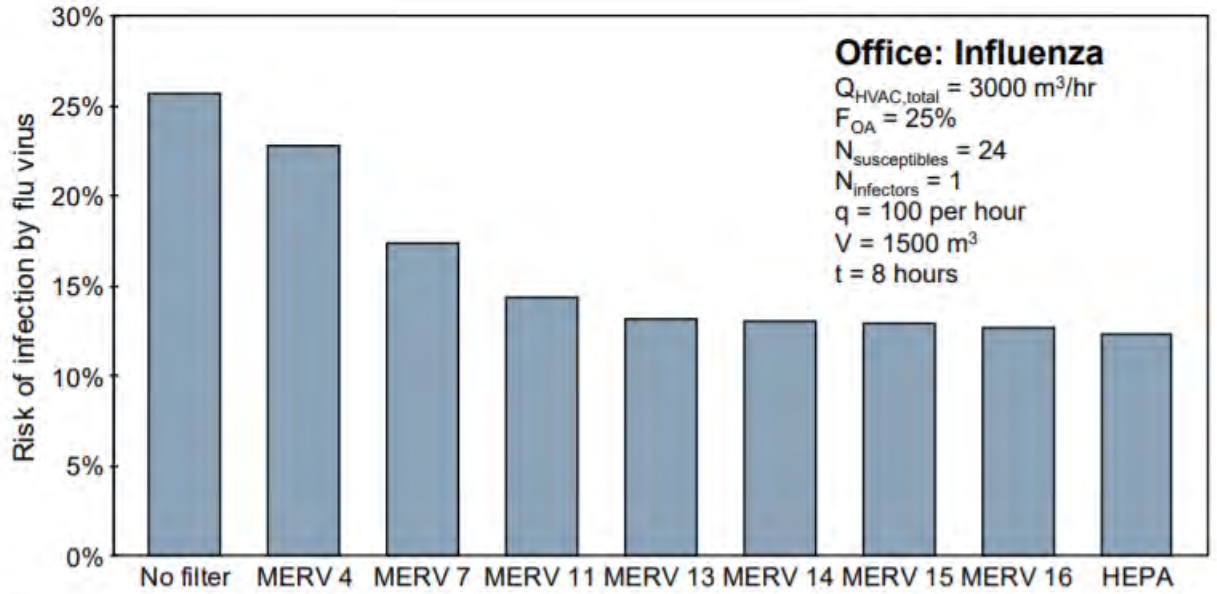

Figure 6. Projected risk of infection by influenza virus during an 8-hour workday in a hypothetical office building with 25 occupants and 25% outdoor air supply using a range of HVAC filters installed in a system with a recirculation rate of 1.5 per hour

Cost of Filtration Versus MERV

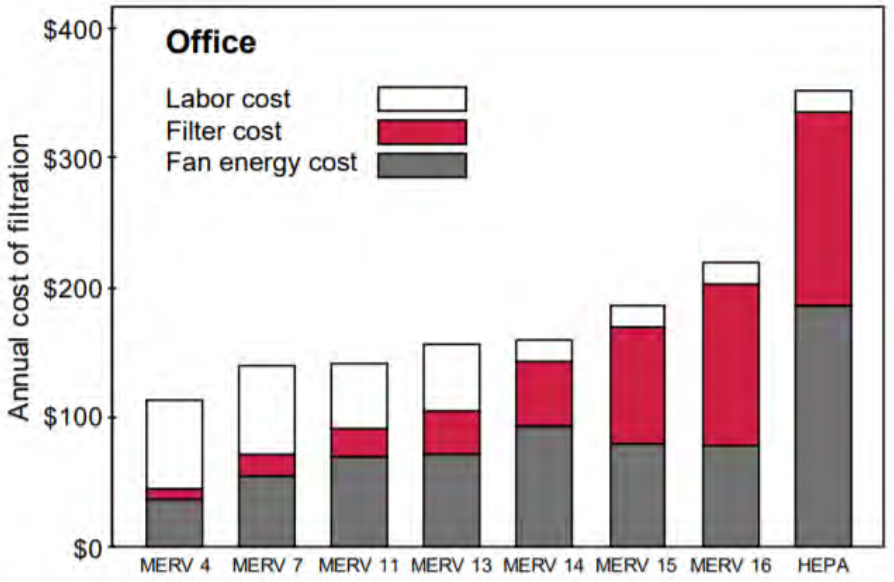

Figure 17. Estimated annual cost of filtration in the hypothetical office environment

Source: Stephens, B. HVAC Filtration & Wells Riley Approach. *Built Environment.* 3/1/12.

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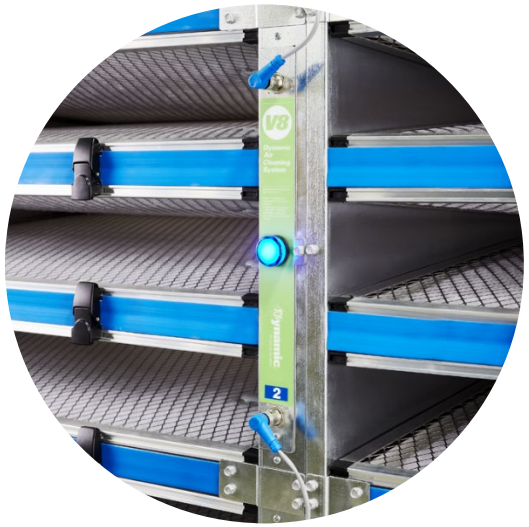
AIR TREATMENT ɤ ELECTRONICALLY CHARGED FILTERS

Electronically charged filters use active-field polarized media to remove particles from the air. Another inherent mechanism of polarization uses particle agglomeration whereby ultra fine particles become polarized after passing through the air cleaner and as a result of polarization are attracted to each other, in addition to other chemical contaminants, to form bigger particles that are subsequently captured.



Does not require frequent filter changes and is a good option for large plant retrofits

Equivalent to a MERV 15 filter

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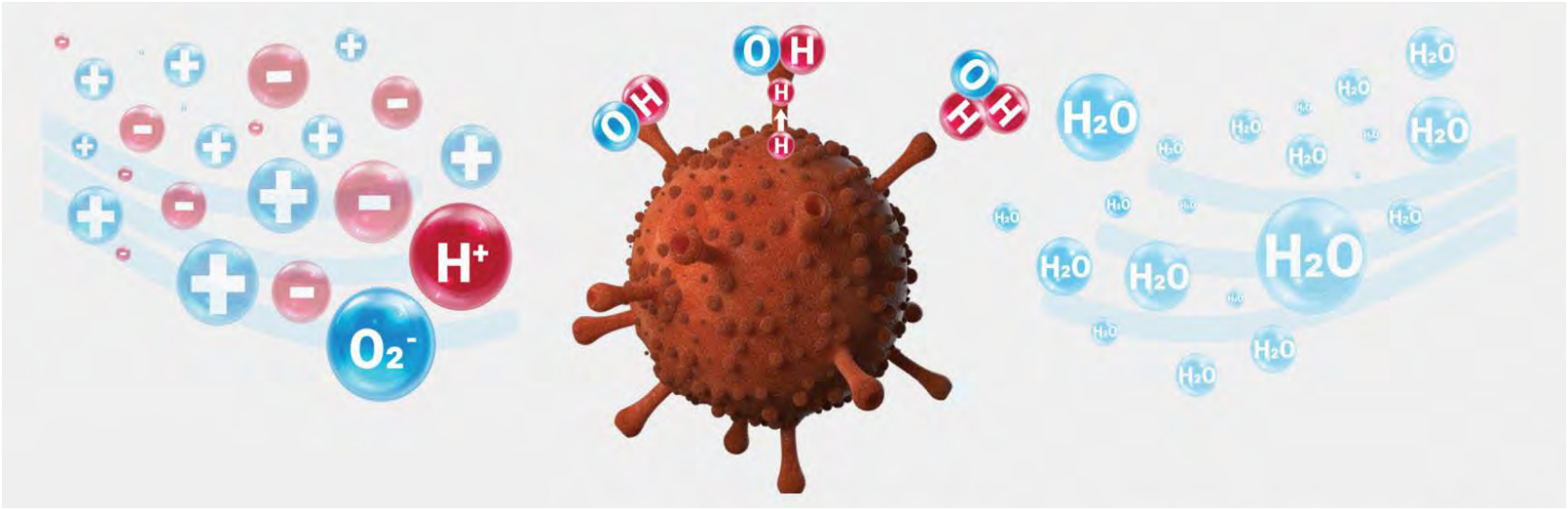
AIR TREATMENT ע BI-POLAR IONIZATION

Bi-Polar Ionization works by introducing positive and negative ions into the air via the supply side of ducts. The ionization causes production of clusters of hydroxyl (OH) radicals which are formed on the surface of microbes, removing hydrogen from the microbes cell wall, thereby inactivating the virus.

Bi-Polar Ionization



ASHRAE Position: Systems are reported to range from ineffective to very effective in reducing airborne particulates and acute health symptoms. Convincing scientifically-rigorous, peer-reviewed studies do not currently exist on this emerging technology; manufacturer data should be carefully considered.

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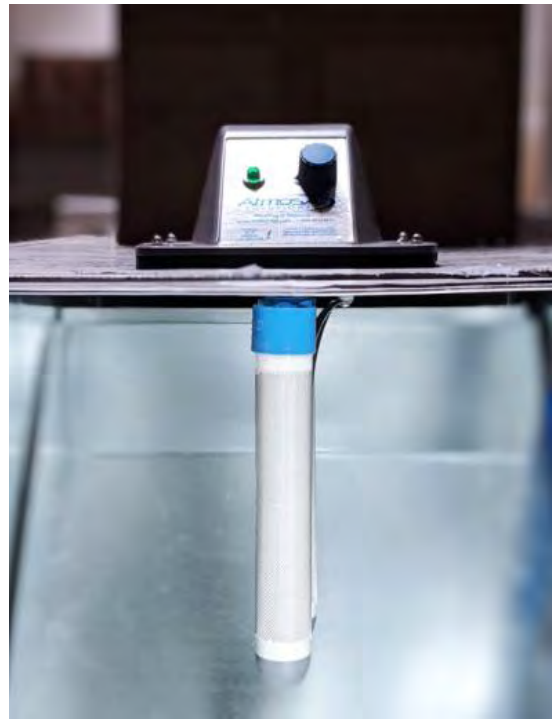
AIR TREATMENT ɀ BI-POLAR IONIZATION

Installation is most often in supply ducts, but can also be rack-mounted in plenums, in air handling units, or smaller units can be installed within fan coil unit plenums.

Bi-Polar Ionization

The unit has negligible air pressure drop, and can be easily retrofitted to an existing HVAC system.



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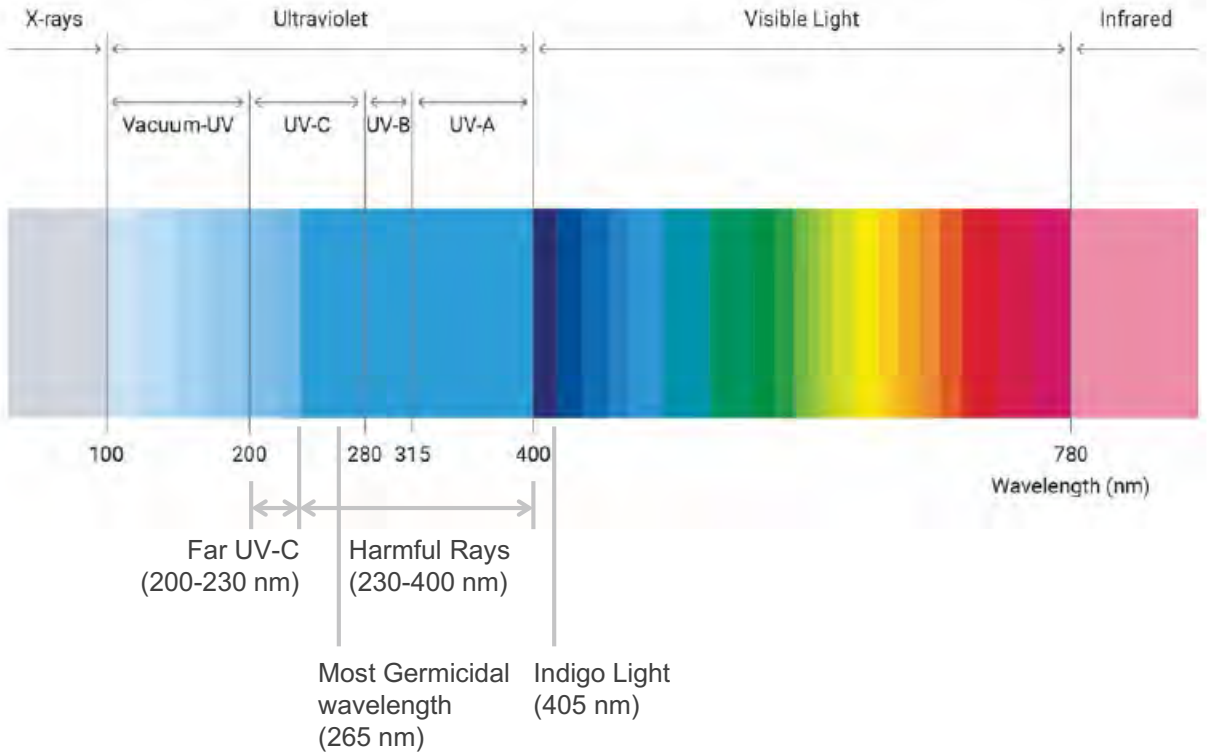
AIR TREATMENT ɀ UV LIGHT SANITIZERS

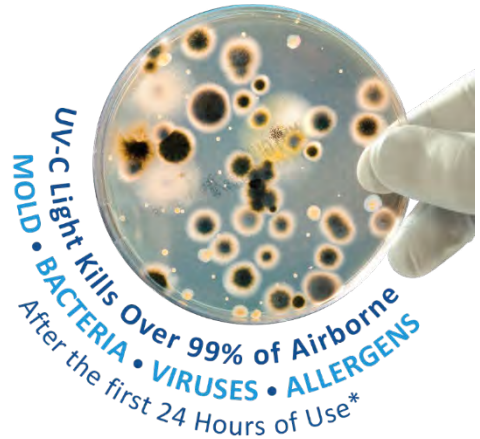
Ultraviolet light kills bacteria and viruses by destroying bonds that hold their DNA together as particles pass under the UV light they are destroyed. UV-C energy in the wavelengths from 200 to 280 nm provides the most germicidal effect, with 265 nm being the optimum wavelength. Exposure to UV-C rays is harmful to occupants.

UV Light Sanitizers

Effectiveness is based on how long air is exposed to UV (resonance time) which is typically 6-10 seconds to kill the virus

ELECTROMAGNETIC SPECTRUM





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AIR TREATMENT ɀ UV LIGHT SANITIZERS

Installation can be in-duct or in AHUs. Lamps installed inside HVAC generally focus on cooling coils & drain pans.

The majority of modern UVGI lamps create UV-C energy at a near optimum 254 nm wavelength

Works by installing banks of UV-Lamps inside HVAC systems or associated ductwork. Consider adding to return air plenums.

Requires high UV doses to inactivate microorganisms on-the-fly as they pass through the irradiated zone due to limited exposure time.

- Systems typically designed for 500 fpm moving airstream.
- Minimum irradiance zone of two feet
- Minimum UV exposure time of 0.25 second.

Should always be coupled with mechanical filtration.

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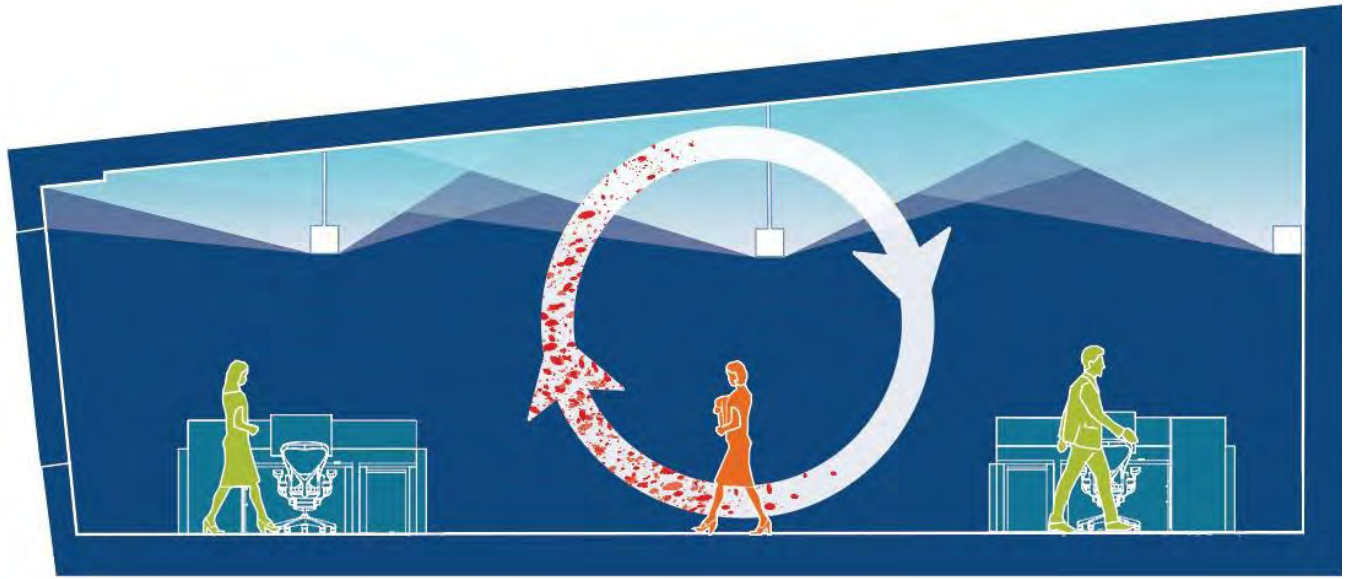
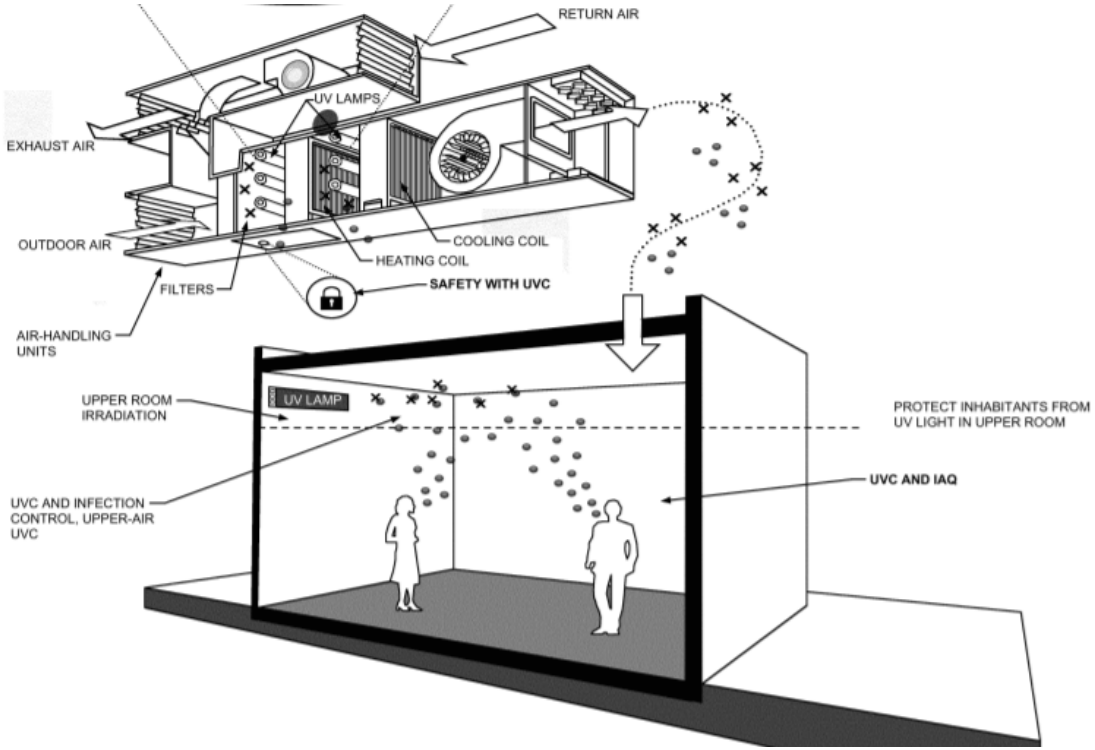
AIR TREATMENT צ UV LIGHT SANITIZERS

Upper room UV disinfection involves mounting lights from the ceilings or on the walls and pointing them upwards to disinfect the upper room air. It can be used in combination with in-duct UV for maximum effect. The UV-C lamps must be mounted 7ע in the air to protect inhabitants from the harmful UV rays. Requires low UV-reflectivity of walls and ceilings and ventilation should maximize air mixing (supplemental fans needed where ventilation is insufficient).



Upper Room Air UV Light Disinfection



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AIR TREATMENT ע UV LIGHT SANITIZERS

Portable, fully automated units that can be controlled remotely. Effective on air and surfaces where the light can penetrate (not in shadowed areas).

Units have settings for specific pathogens such as MRSA, C. difficile, both of which are harder to inactivate than coronaviruses.

- >99.9% reduction of vegetative bacteria within 15 minutes[1]
- 99.8% for C. difficile spores within 50 minutes[1]

Pulsed Xenon lamps: High-powered UV lamps (generally containing xenon gas) used in rapid pulses of intense energy. Emits a broad brand of visible and ultraviolet wavelengths, with a significant fraction in the UV-C band. Uses significantly higher power outputs than usual UV-C techniques.

1. Weber DJ1, Rutala WA, Miller MB, Huslage K, Sickbert-Bennett E. Role of hospital surfaces in the transmission of emerging health care-associated pathogens: norovirus, Clostridium difficile, and Acinetobacter species. American Journal of Infection Control 2010..

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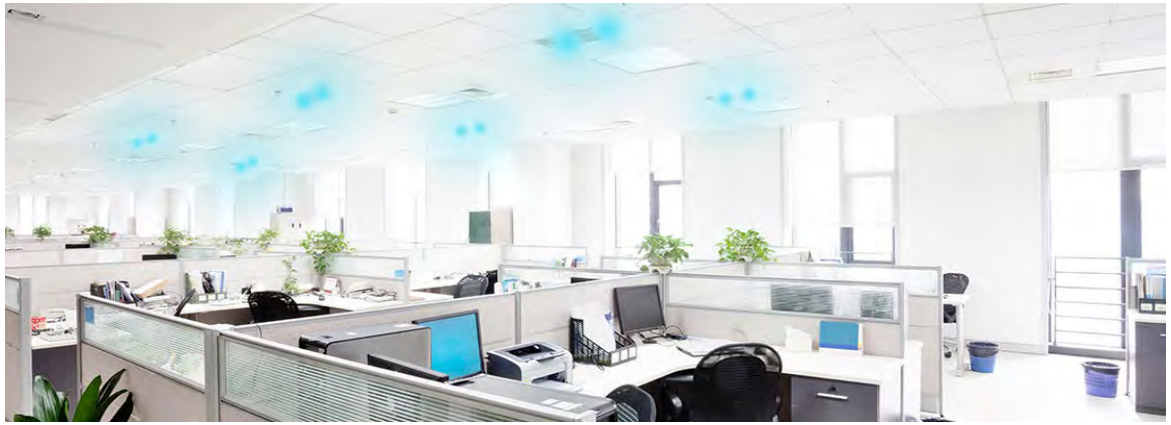
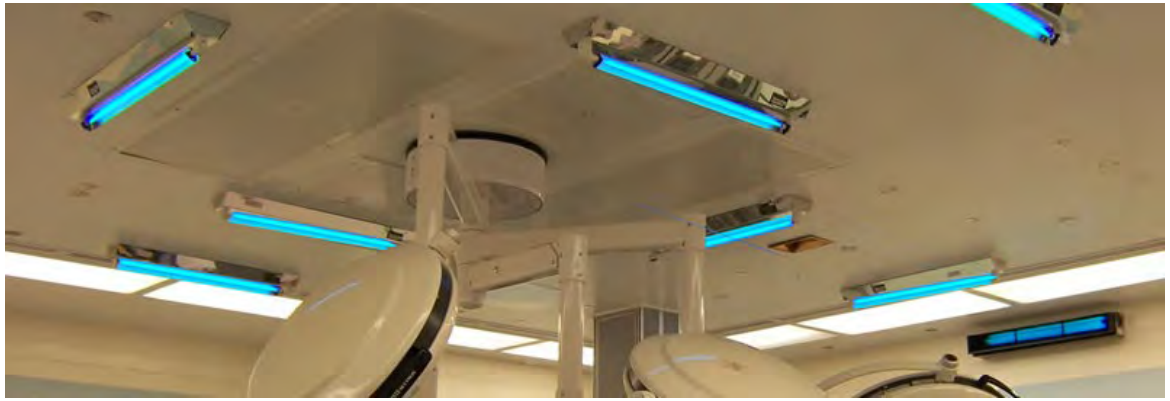
AIR TREATMENT ע UV LIGHT SANITIZERS

UV-C lights on occupancy sensors so they can sanitize spaces when unoccupied.

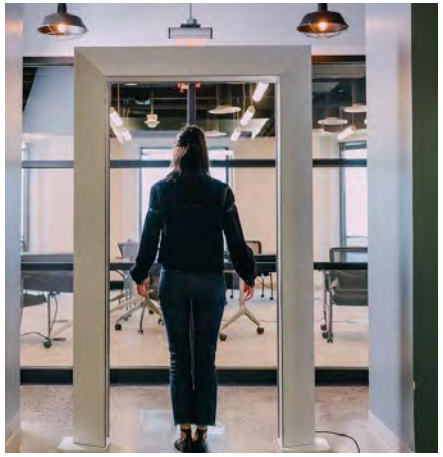




More UV-C lights in various shapes and styles are currently in development, including UV-C LEDעs which are emerging for use.

Far UV-C lights (200-230 nm spectrum) can sanitize without harming occupants[1]. Awaiting more testing.

One cleanse per 800ft3 achieves 4 air exchanges per hour (50cfm) and also includes a HEPA & Carbon filter



Individual downlights and doorway disinfection technology currently in development

1. Rich M. Simons, Far UV-C in the 200 ע 225 nm range, and its potential for disinfection applications. IUVA July 2020. https://bit.ly/2B5rYaa

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AIR TREATMENT ɀ INDIGO CLEAN

A dual-mode disinfecting light system that remains in the visible light spectrum, operating at 405nm. It is safe for human occupancy while on and has the ability to be on 24/7. The number of studies documenting its performance are very limited and the required exposure times required are relatively long.

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HVAC || AIR TREATMENT - UV LIGHT SANITIZERS

Upper room UV disinfection has been found to have the most effect at UV sanitization. The UV-C lamps must be mounted 7ע in the air to protect inhabitants from the harmful UV rays.

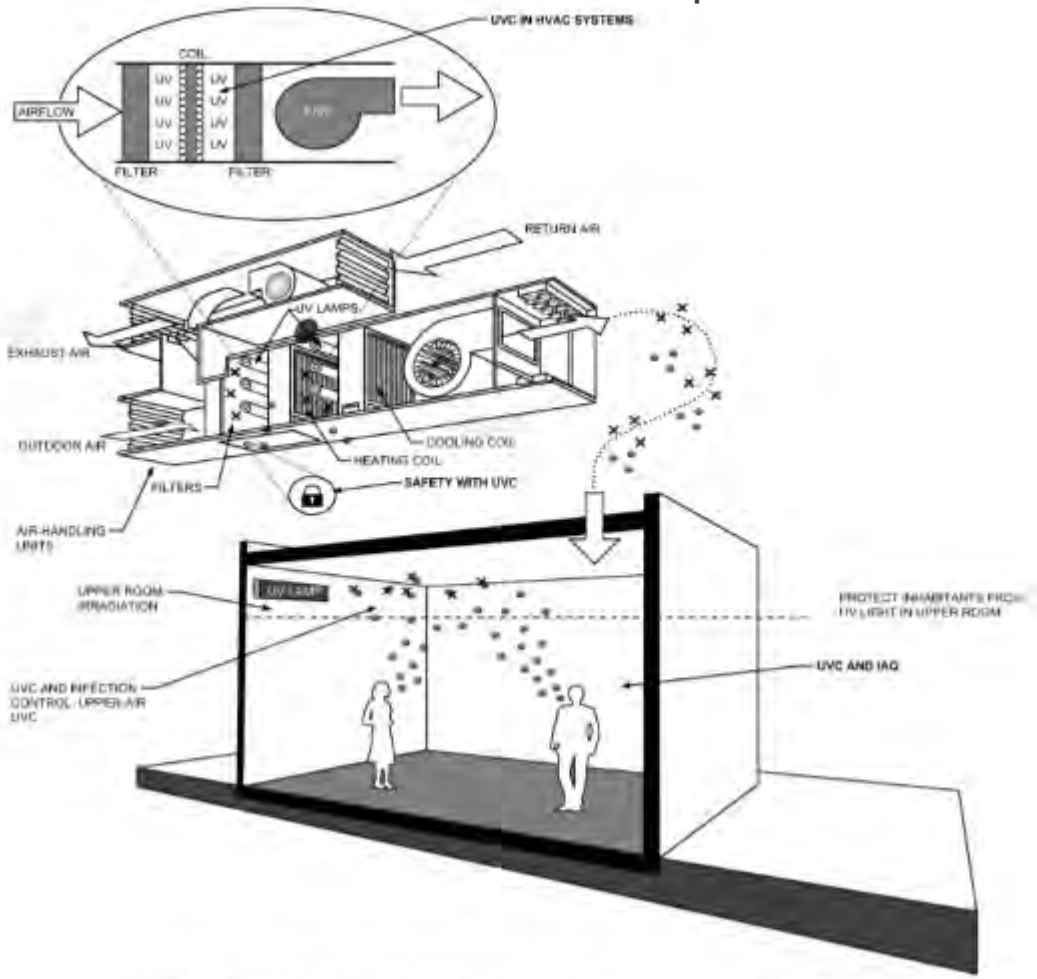
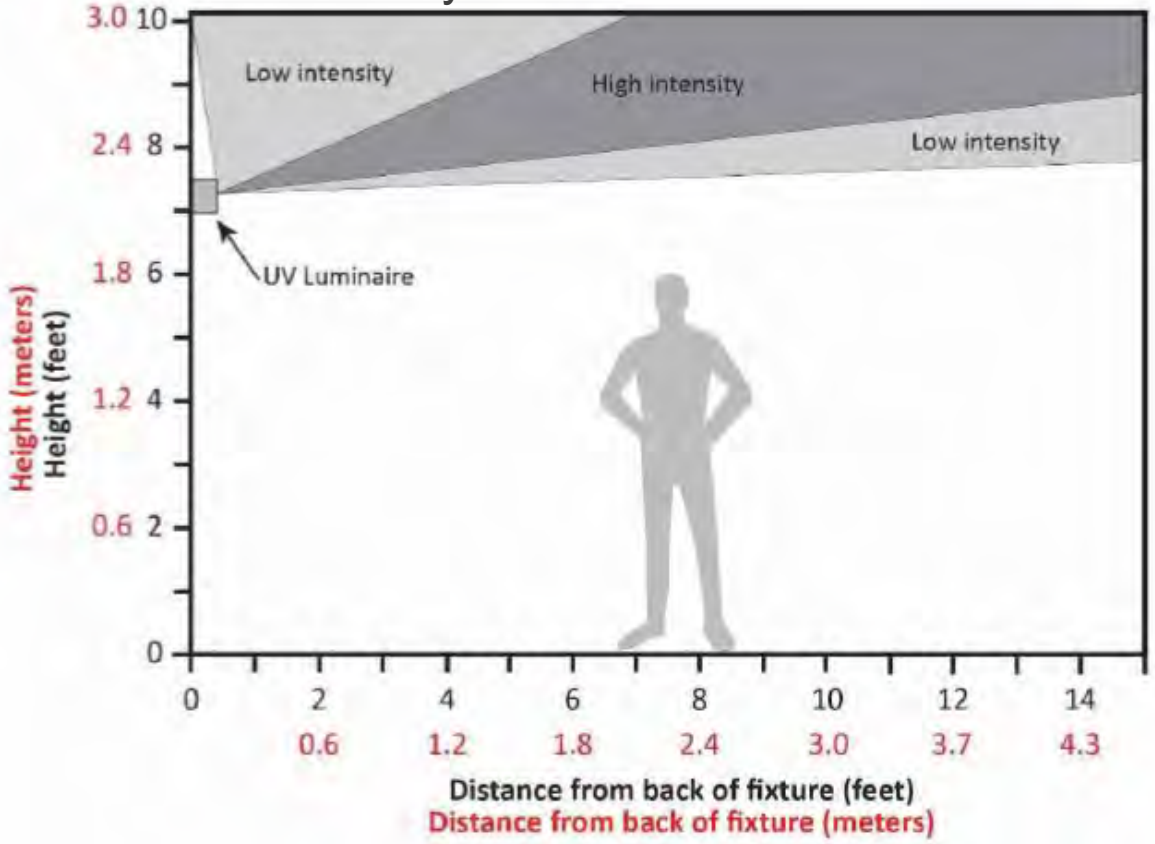


Fig. 1 Potential Applications of UVC to Control Microorganisms in Air and on Surfaces
(ASHRAE 2009)



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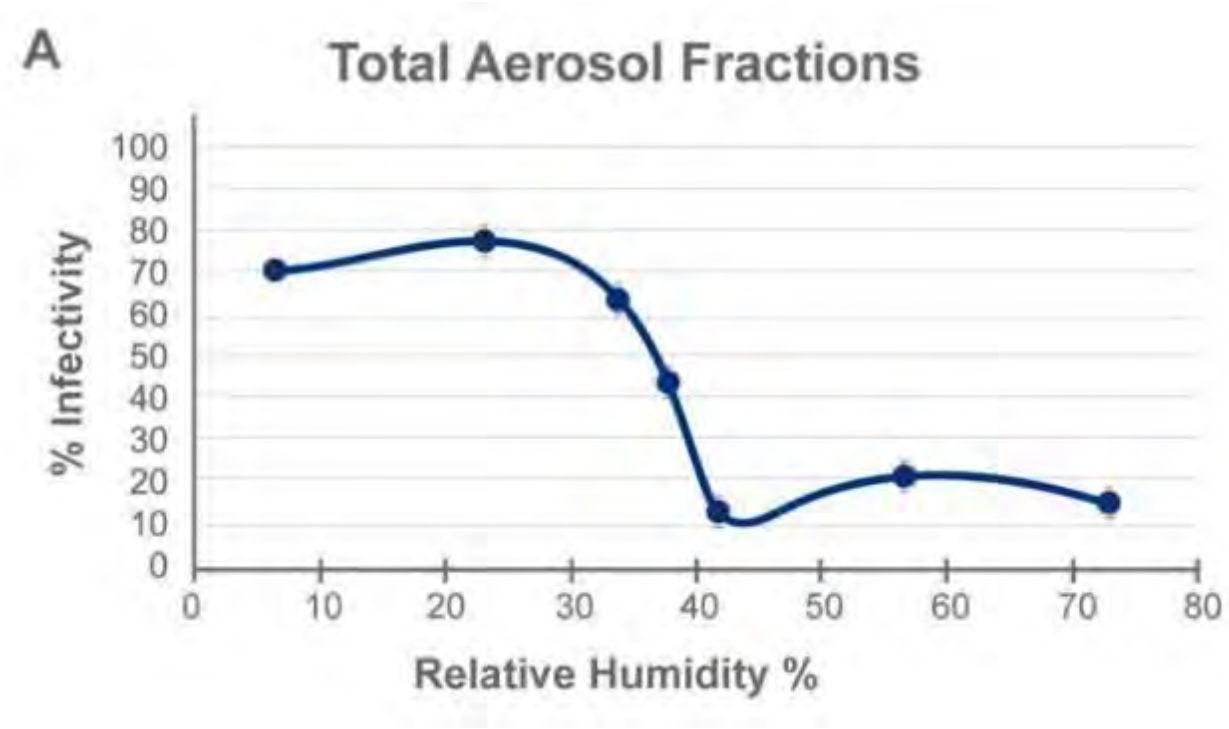
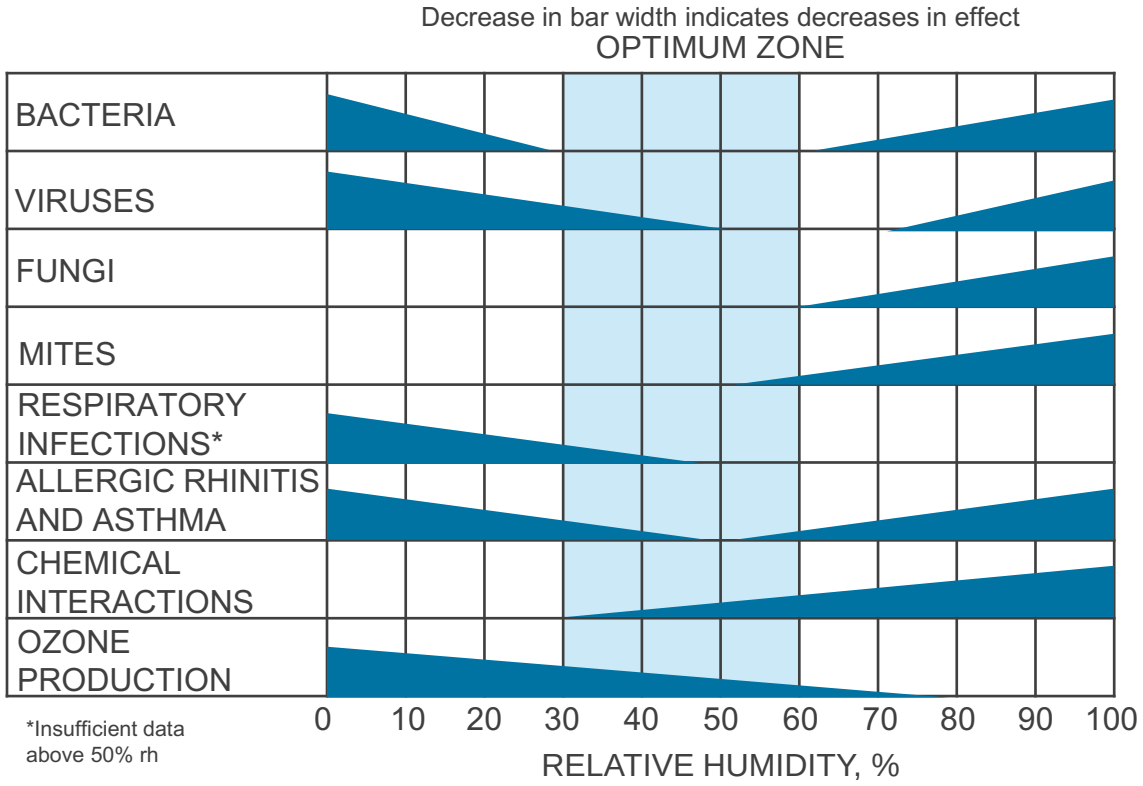
HVAC || HUMIDIFICATION

- Higher humidity reduces infectivity of influenza[1]
- Membranes in the nose dry out quicker in low humidity[2]
- Low humidity results in breathing smaller particles[3]





1. *John Noti, et al, Humidity Leads to Loss of Infectious Influenza Virus from Simulated Coughs (February 27, 2013)*
2. *J.P. Guggenbichler, R. Huster and S. Geiger, Luftfeuchtigkeit und Immunabwehr Die Rolle der Schleimhaut und Auswirkungen auf die Klimatechnik (2007) Tab Technik AM, Vol. 38 No. 9*
3. *ASHRAE Guidelline 10-2016, Interactions Affecting the Achievement of Acceptable Indoor Environments*

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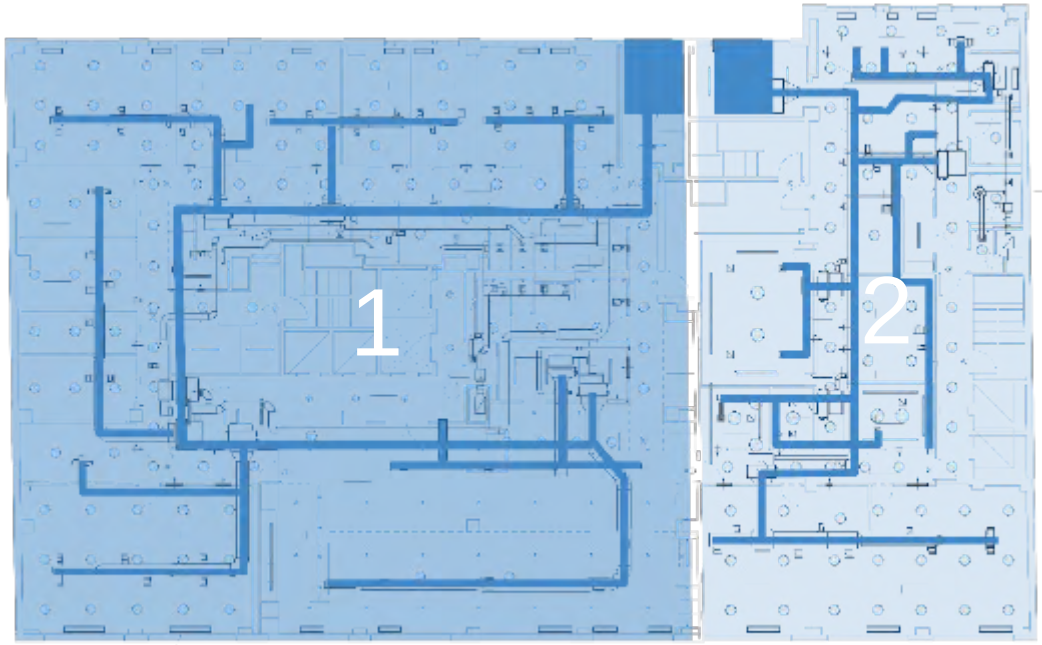
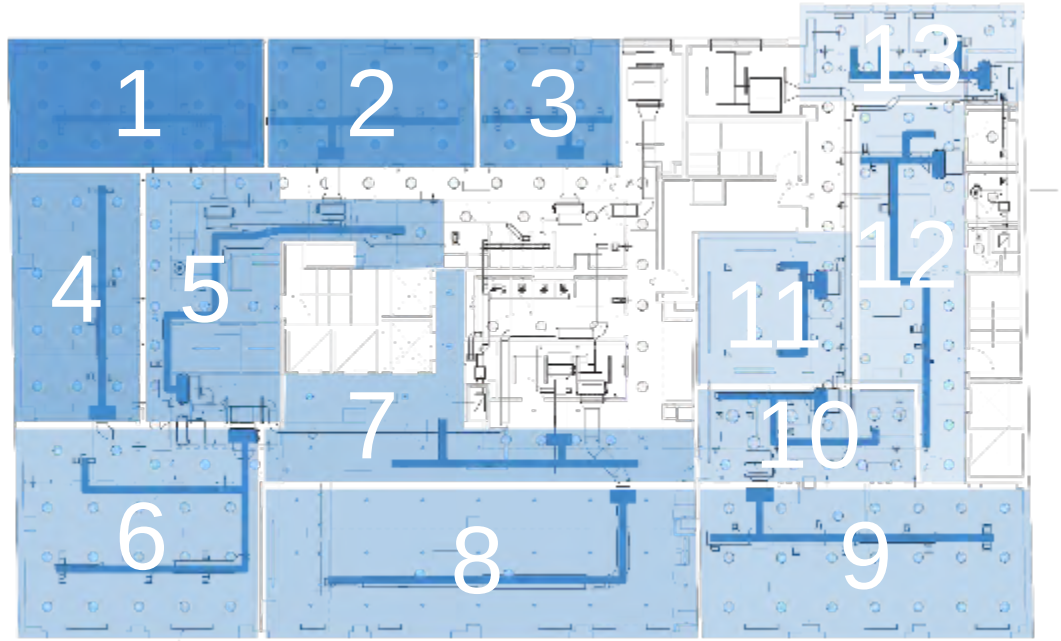
HVAC || HVAC ZONES

Using smaller zones (500 sf) will lower recirculation of air. Consider use of VRF or DOAS systems.



Typical zoning with Floor-by-Floor AHU

Floor by floor AHUs have a higher efficiency filter (typically MERV 8-13) but the mix of outside air percentage can vary and contamination zones are larger.



Multiple small zones from use of VRF system

VRFs have a lower efficiency filter but can be retrofitted to accept a MERV 8 or potentially higher efficiency filter. Percentage of outside air is assured.

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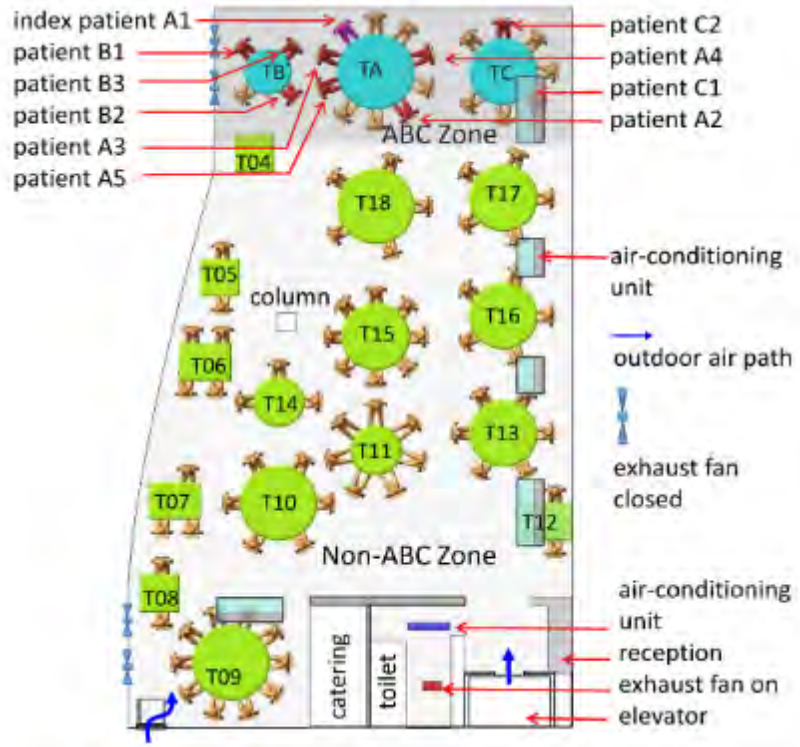
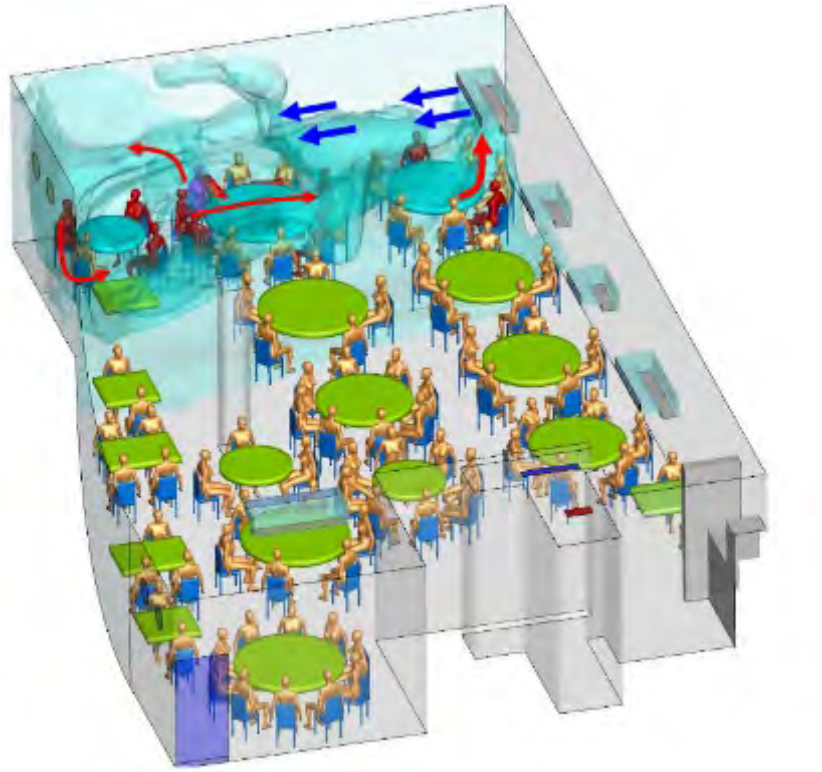
HVAC || HVAC ZONES

AIR CIRCULATION AND VENTILATION





COVID-19 Outbreak Study within a Restaurant in Guangzhou, China
January 24, 2020, 12:00 PM, Chinese New Years Eve luncheon
5-story restaurant, 3rd floor of the restaurant

Source: Lu J, Gu J, Li K, Xu C, Su W, Lai Z, et al. COVID-19 outbreak associated with air conditioning in restaurant, Guangzhou, China, 2020. Emerg Infect Dis. 2020

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TOUCHLESS TECHNOLOGY

Doors & Entryways

Destination Dispatch Elevators

Automatic Doors (motion sensor, facial recognition, optical foot sensor)

Pantries

App-based coffee and water machines

Motion sensor faucet with 20 second timer and soap dispensers

Touchless cabinets or open shelves for frequently used items

Use bottle fillers instead of drinking fountains

Bathrooms

Motion sensor flushometer, faucet with 20 second timer, and soap dispenser

Paper towels instead of automatic hand dryers

UV disinfecting on seats

UV lamps in bathrooms for after-hours disinfection

Lighting

Lighting Controls

Automated Shading

BMS & app-based controls for lighting controls & automated shading

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TECHNOLOGY || TOUCH-FREE SOLUTIONS

Touch-free Technology in Common Areas

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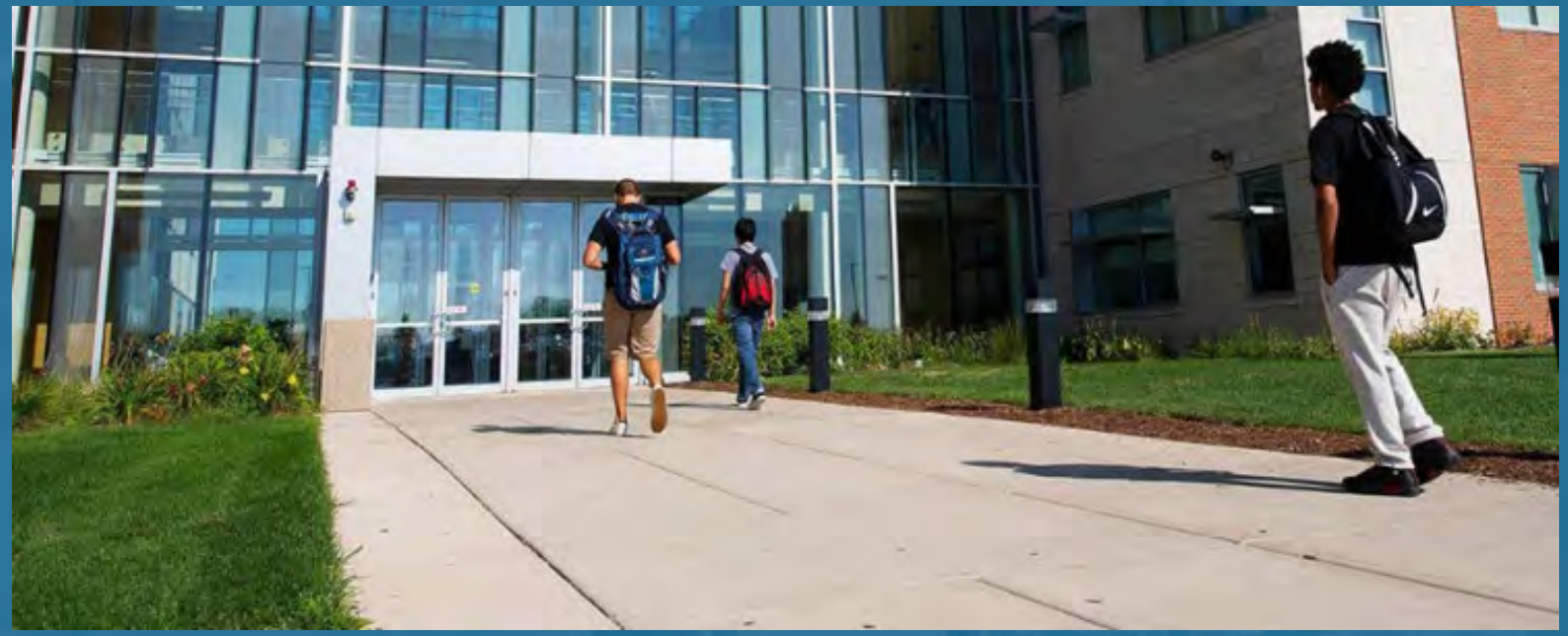
TECHNOLOGY || BUILDING ENTRY

- Touch-Free Entry / Exit
- Thermal Scanning Stations
- App-based Technology



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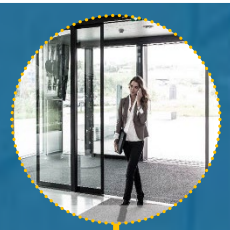
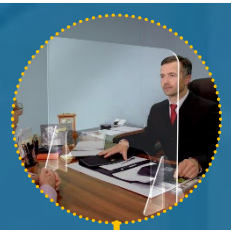
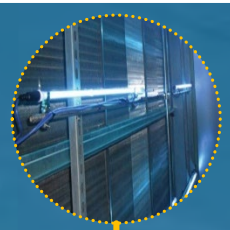
BUILDING LOBBY

Automatic doors



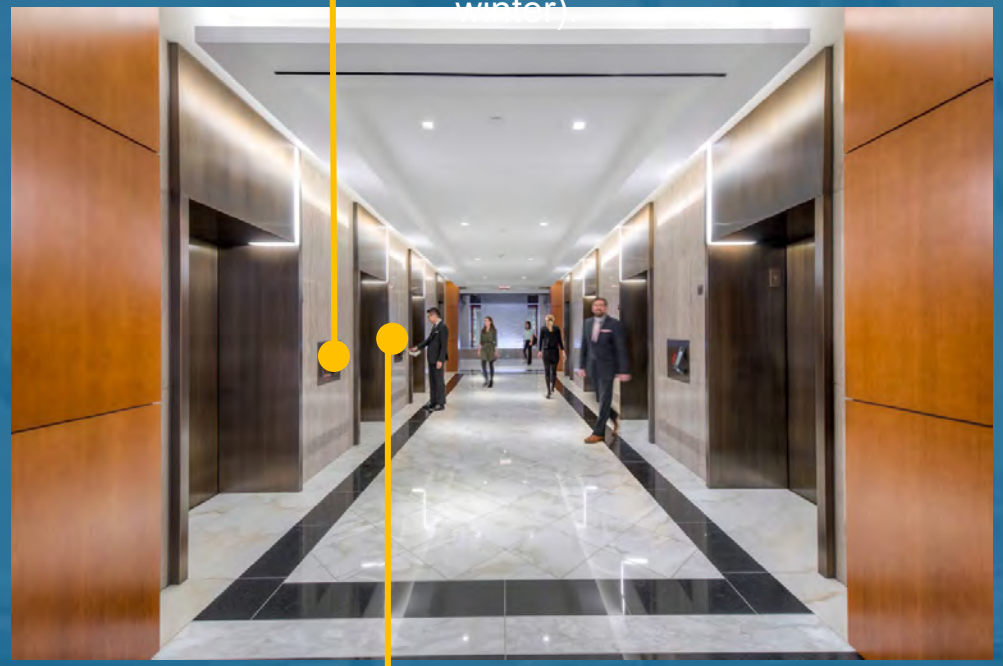


Plexi barrier for security/ reception desks

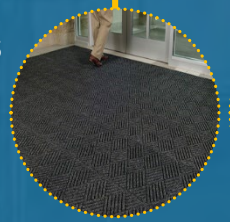


Increase outside air, enhanced filtration, and air treatment systems

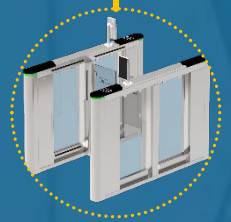
Touchless destination dispatch system via card or mobile app. Keep elevator doors open at lobby/floors
(note stack effect concern in winter)



Entryway mats



Sanitization station at entry



Facial recognition/mask scanning, thermal scanning, and touch-free security

Minimize elevator occupancy and use floor stickers. Consider UV & HEPA filters in elevator cabs.

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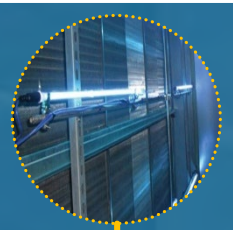
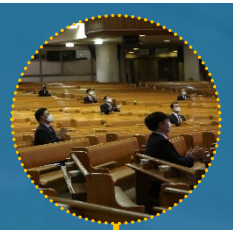
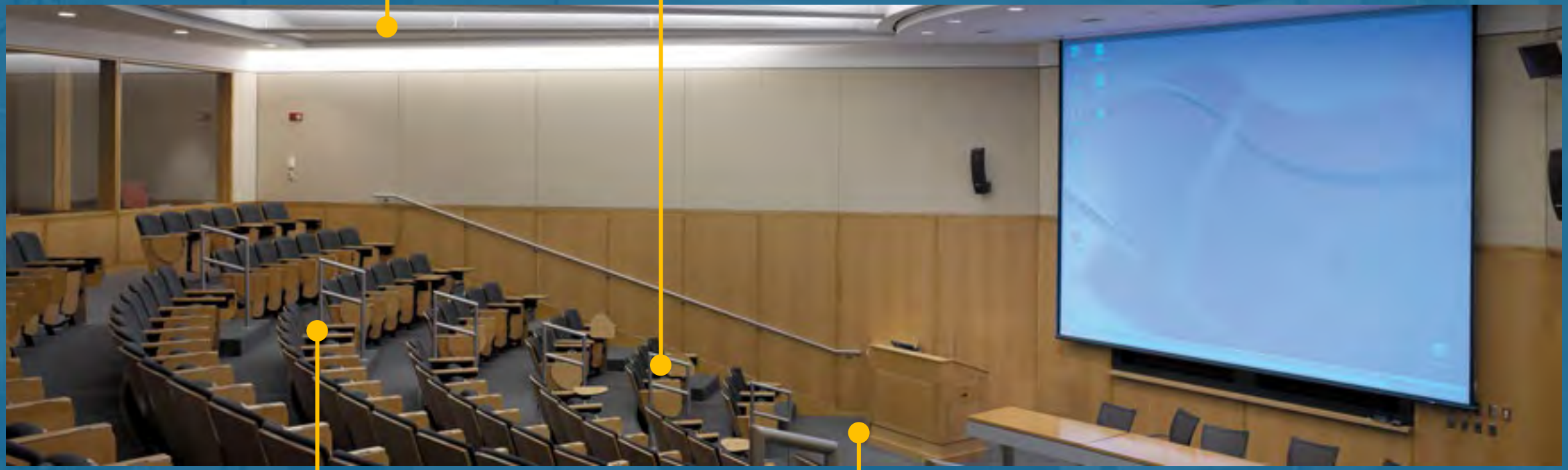
AUDITORIUMS

Increase outside air, enhanced filtration, and air treatment systems





Space out seating, add CO2 sensors, consider portable air filtration.



Desk dividers between seats

Floor markings for circulation and 6’ separations

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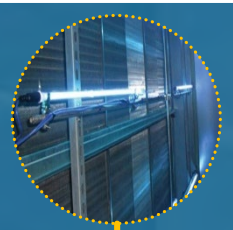
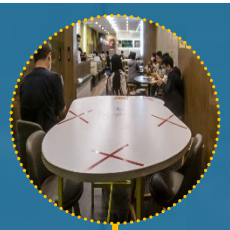
OPEN OFFICE

Increase outside air, enhanced filtration, and air treatment systems





For conference rooms space out seating, add CO2 sensors, consider portable air filtration. Reduce open collab/touchdown spaces.

Desk dividers for existing desks

Larger or separated workstations, stagger work hours and occupancy (occupy every other desk) for social distancing

Floor markings for circulation and 6’ separations

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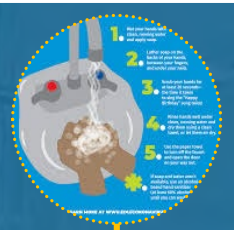
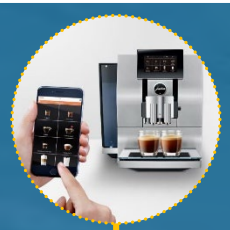
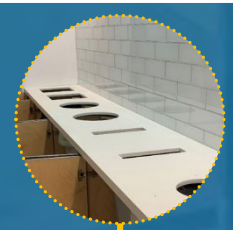
PANTRIES



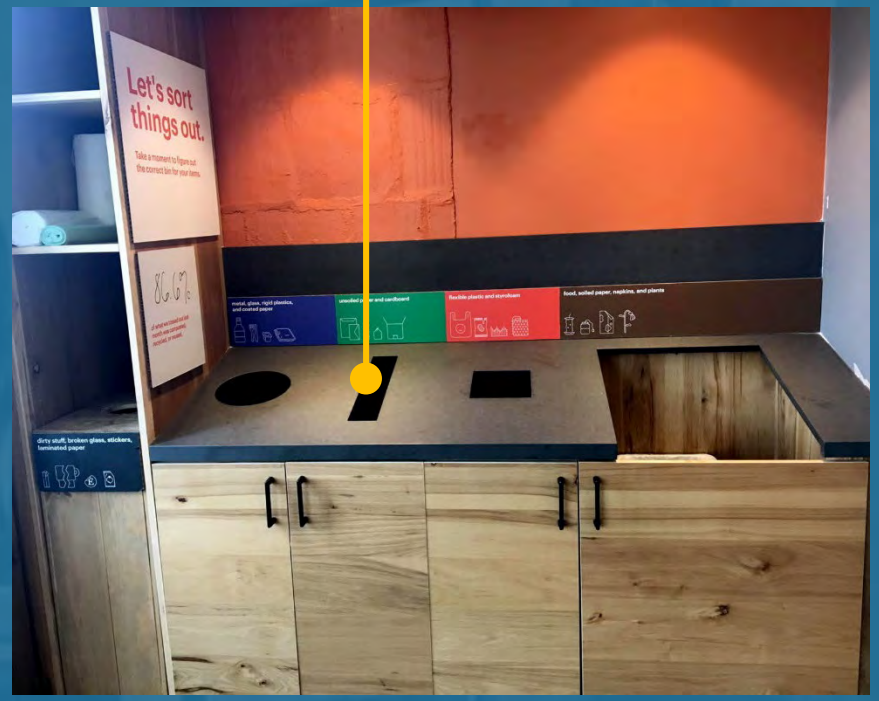
Handwashing education posters



App-based coffee machine and automatic water bottle filler



Countertop cut-outs for touchless waste and recycling system



Motion-activated faucet with 20 second timer

Touchless cabinets

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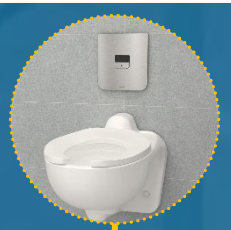
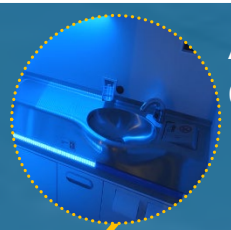
BATHROOMS

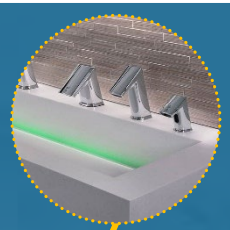
Increased Bathroom Exhaust



Automatic Flushometers

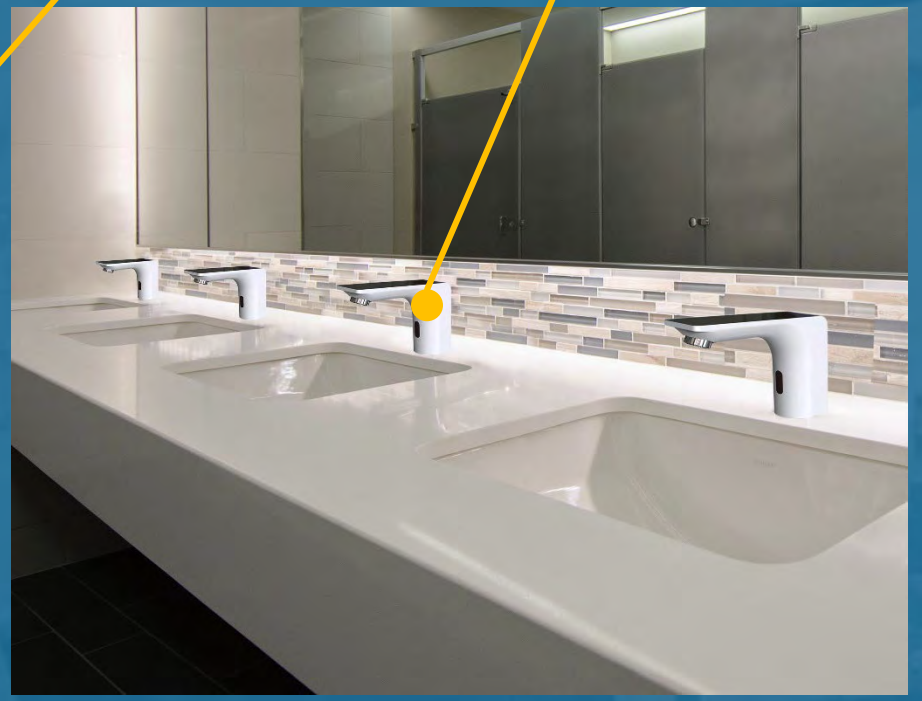


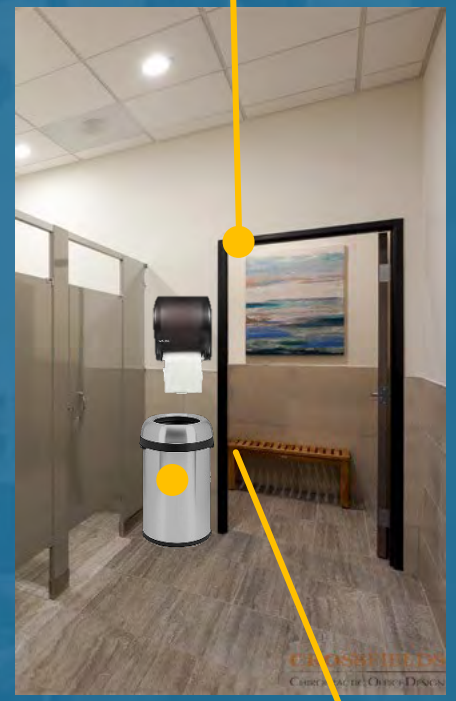
After-hours UV disinfection



Motion-sensor 20 second faucet and automatic soap dispenser

Automatic bathroom doors or foot pulls





Full-height water closet partitions ($7,500/unit)

Automatic closing lids, optional UV disinfection (not yet readily available)

Automatic paper towel dispensers and open trash can located by door. Disable air dryers

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OPERATIONAL CONCEPTS

Proactive things building owners can do

Cleaning

New cleaning protocols

More regular deep cleaning

Frequent cleaning of common touchpoints

Increase supply of sanitizing products

Ductwork and unit cleaning

Air Quality

Changing filters

Monitoring air quality

Extending ventilation hours and after-hour purge with outside air

Screening Protocols

Thermal Camera Scanning/Elevated Body Temperature (EBT) checks

Staggered Arrivals and Departures

Packages Sanitization

Commissioning

Commissioning of systems with periodic validation

Creating operations and maintenance manuals for staff

Create a best practices manual for tenants

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INCREASED CLEANING STRATEGIES

Deep Cleaning

Regular deep cleaning of tenant spaces and common areas

Periodic fine mist/fog of space with germicide solutions

Flush building pipes & prime floor drains before reoccupation

Elevator cab UV sterilization

Packages

Sterilization space for incoming packages (with UV sterilization)

Sanitization Stations

Add sanitization stations at entrances and throughout office

Provide tissues, soap, hand sanitizer, and disinfecting wipes in the offices and by copy machines, common areas

Lease Terms

Review lease terms on general cleaning and nightly deep cleaning for building common areas

Update facility maintenance contract to include additional cleaning (such as cleaning of desks, multiple cleanings of common areas on tenant floors)

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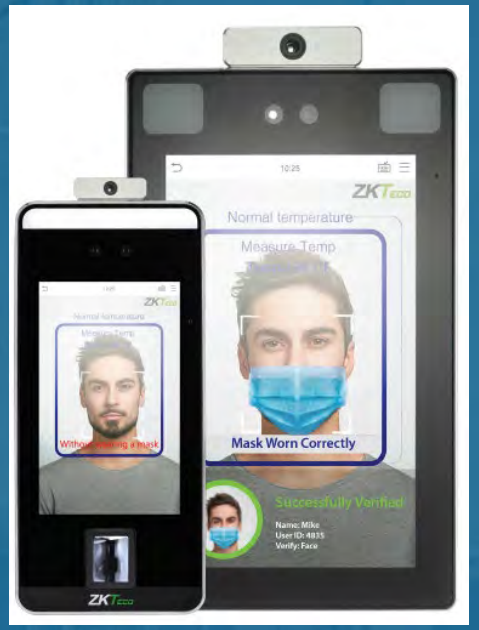
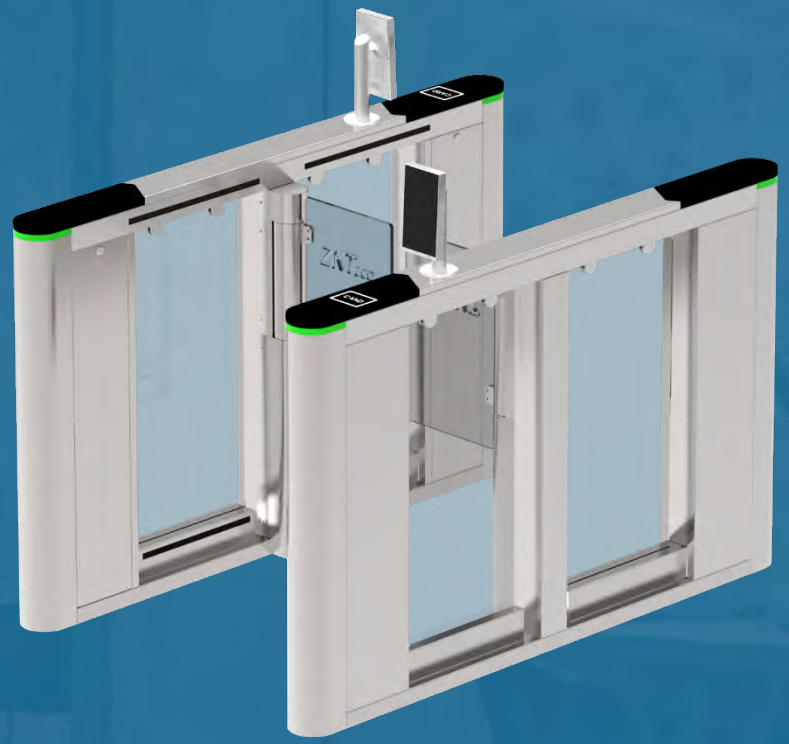
THERMAL SCANNING

This thermal scanning system works at the turnstile and has facial recognition, mask recognition, and thermal scanning. Facial recognition can be turned off to protect privacy.





https://www.youtube.com/watch?v=PLqdXJLo5Uc

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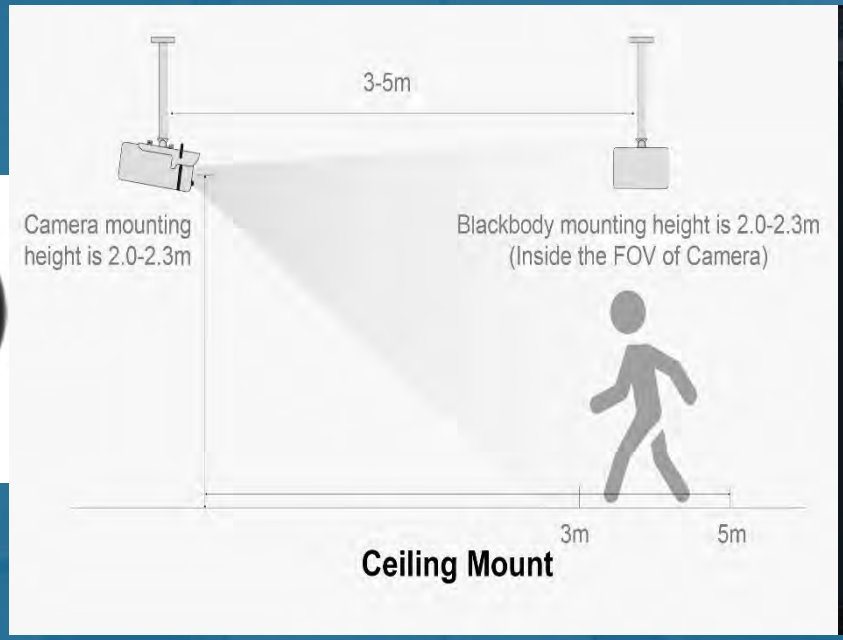
THERMAL SCANNING

This solution is for large volume scanning without turnstiles and can scan from 20 feet away.



SMART BUILDING WORKPLACE MANAGEMENT

Help maintain social distancing requirements

Contact tracing identification and reporting

Instant communication

Smart Building Digital Platform

- Ultra high-speed connectivity (DAS/5G)
- Artificial Intelligence (AI)
- Analytics - IoT
- Big Data
- CBRS, mmWave
- WIFI 6

Touchless Environment

- Biometrics (Face ID, Iris, Palm)
- Destination dispatch ג touchless lobby turnstiles
- Virtual Assistants/Help Desk
- Voice/Gesture Control ג AV and Conference Sys
- Real Time Occupancy Monitoring
- Social distancing density control
- Dynamic Indoor Wayfinding
- Workspace Management Flexible Seating

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SOCIAL BEHAVIORS

What the building occupants can do

Social Distancing

Always stay 6ע apart

Shifted work schedules (Different days, different hours)

Staggered reoccupancy

One-way office circulation where possible

Education

Educational posters about hand washing, wearing masks, touching your face, and other best practices

Periodic hand washing reminders

20 second timers at faucets

Go Digital

Flexible work from home policy

Use videoconferencing for meetings when possible

Postpone large gatherings

Assess risk of travel

New Protocols

Wearing face masks

Keeping your desk clean

Minimize elevator occupancy

Communication with staff

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IMMEDIATE RECOMMENDATIONS

Healthy Building Checklist

- ❑ Healthy finishes - copper film and materials
- ❑ Gathering spaces with built in social distancing / natural finishes
- ❑ Increase outside air throughout occupied space where possible.
- ❑ Replace existing air handling unit (AHU) filters with MERV 13 or better.
- ❑ Consider Bipolar Ionization
- ❑ Replace all existing AHU UV lights with higher density for 95% or above "on the fly" virus kill.
- ❑ Add UV-C lights to any existing AHU that does not currently have them.
- ❑ Add needlepoint bipolar ionization air purification devices to each existing AHU supply duct.
- ❑ Consider free-standing Hepa Filters in classrooms

NEXT STEPS

Let us know how we may serve you.

CONTACT:

Paula Beck, Interiors Director
e: pbeck@beckdesign.com
o: 918.583.5300
c: 918.691.9157

beckdesign.com

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