

A microscopic image of a virus particle, likely SARS-CoV-2, showing its characteristic spherical shape with a textured surface and a darker core. The image is set against a dark background and is partially obscured by a red rectangular overlay containing text.

# COVID-19 & The Future of Air Filtration

# Agenda

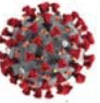


- 1 COVID-19 Transmission
- 2 Changing Filters
- 3 Current Guidance
- 4 Early Market Response
- 5 Mitigation Strategies
- 6 Future of HVAC Filtration

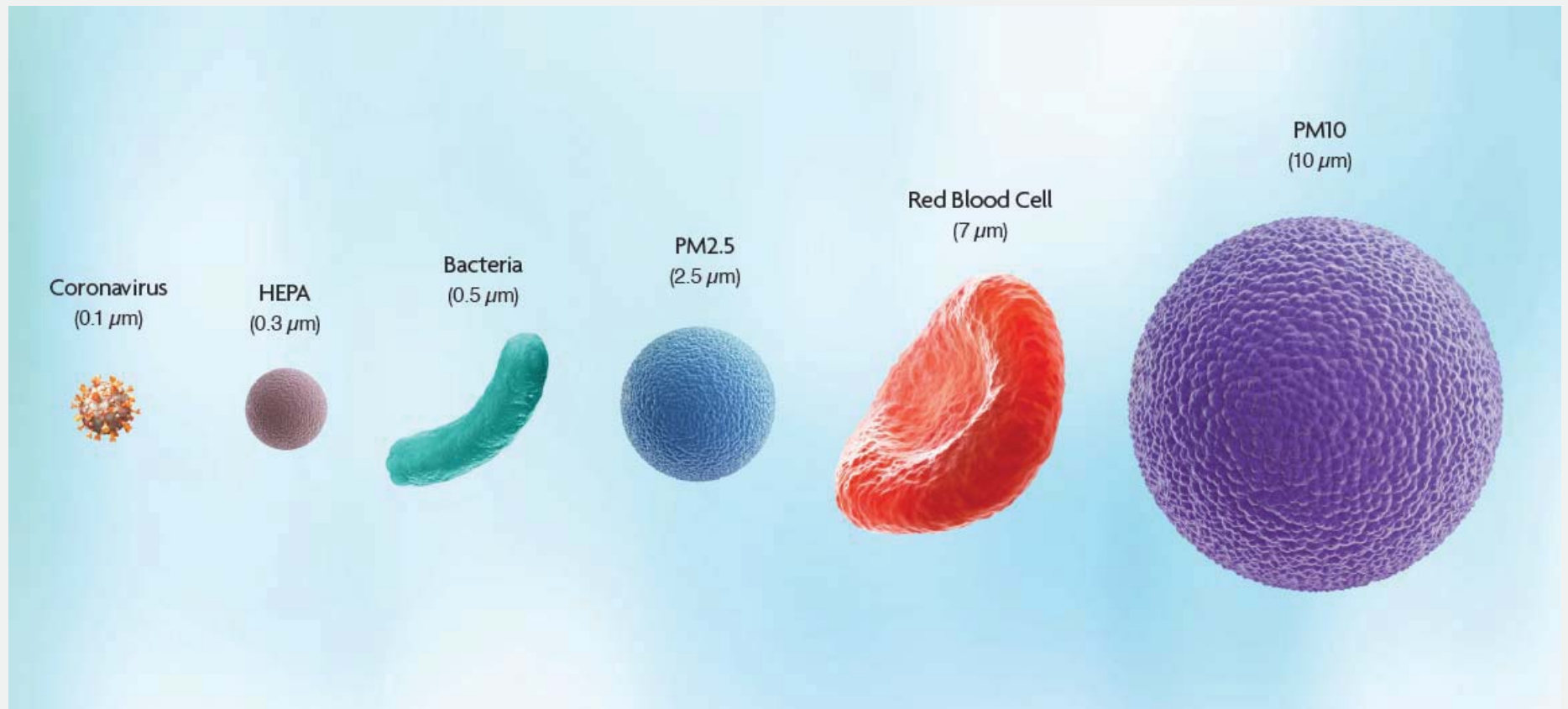
# Will Changing Filters Solve the Pandemic?

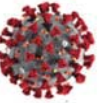
# Will Changing Filters Solve the Pandemic?

No, but improving filter efficiency can help.

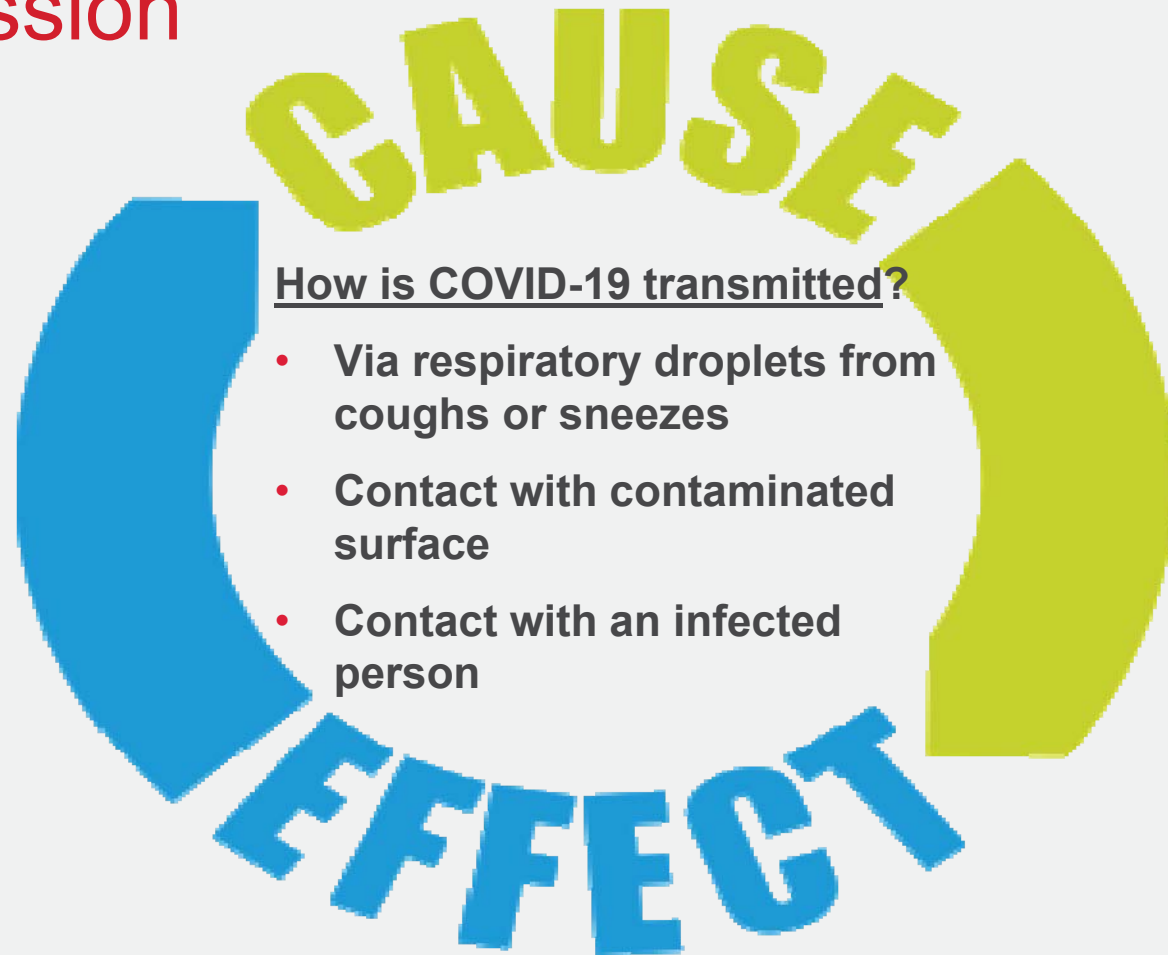


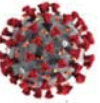
# Sars-Cov-2: 0.1 Micron Diameter





## Transmission



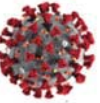


### 3 hours in the air

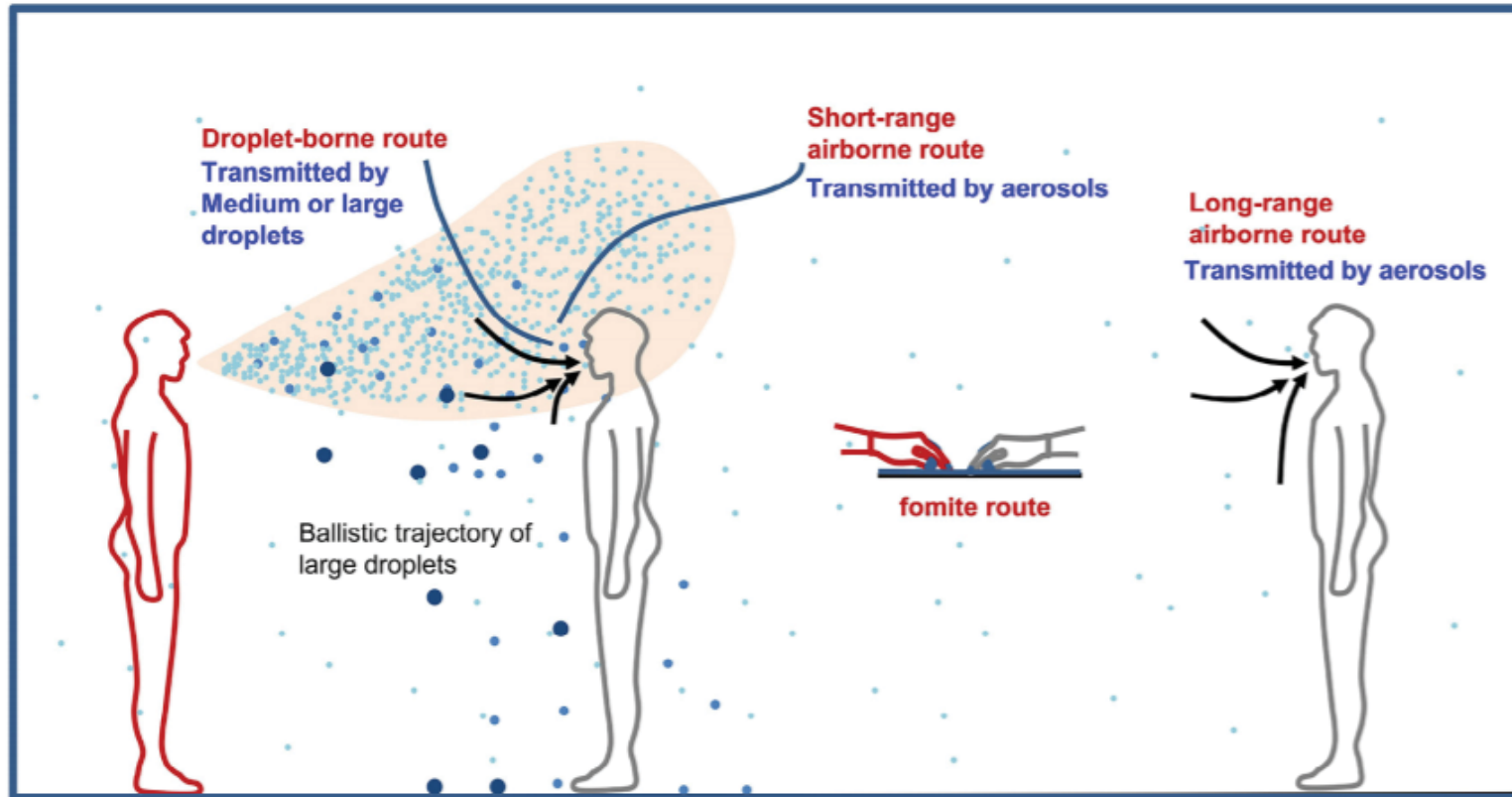
Key evidence emerged March 17, when researchers reported in the *New England Journal of Medicine* that the coronavirus can remain viable not just in droplets that tend to fall relatively quickly, but in tiny droplets called aerosols that can waft about for many minutes or hours.

“SARS-CoV-2 **remained viable in aerosols** throughout the duration of our experiment (3 hours),” they report, indicating that aerosol transmission “is plausible, since the virus can remain viable and infectious in aerosols for hours.”

“Can” and “plausible” are, of course, qualifiers that stop short of “does.”



*J. Wei, Y. Li / American Journal of Infection Control 44 (2016) S102-S108*



- Large droplets (>100  $\mu\text{m}$ ) : Fast deposition due to the domination of gravitational force
- Medium droplets between 5 and 100  $\mu\text{m}$
- Small droplets or droplet nuclei, or aerosols (< 5  $\mu\text{m}$ ): Responsible for airborne transmission



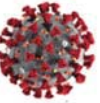
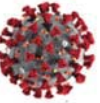


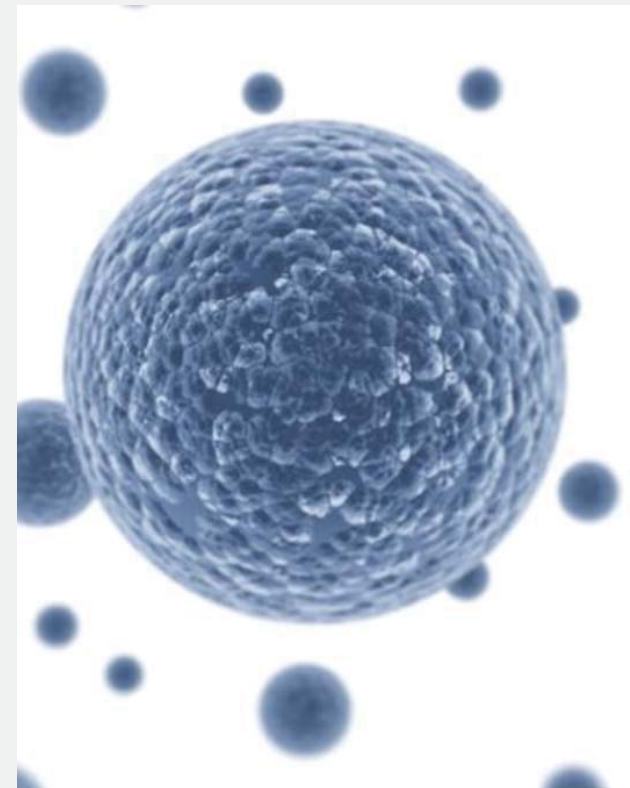
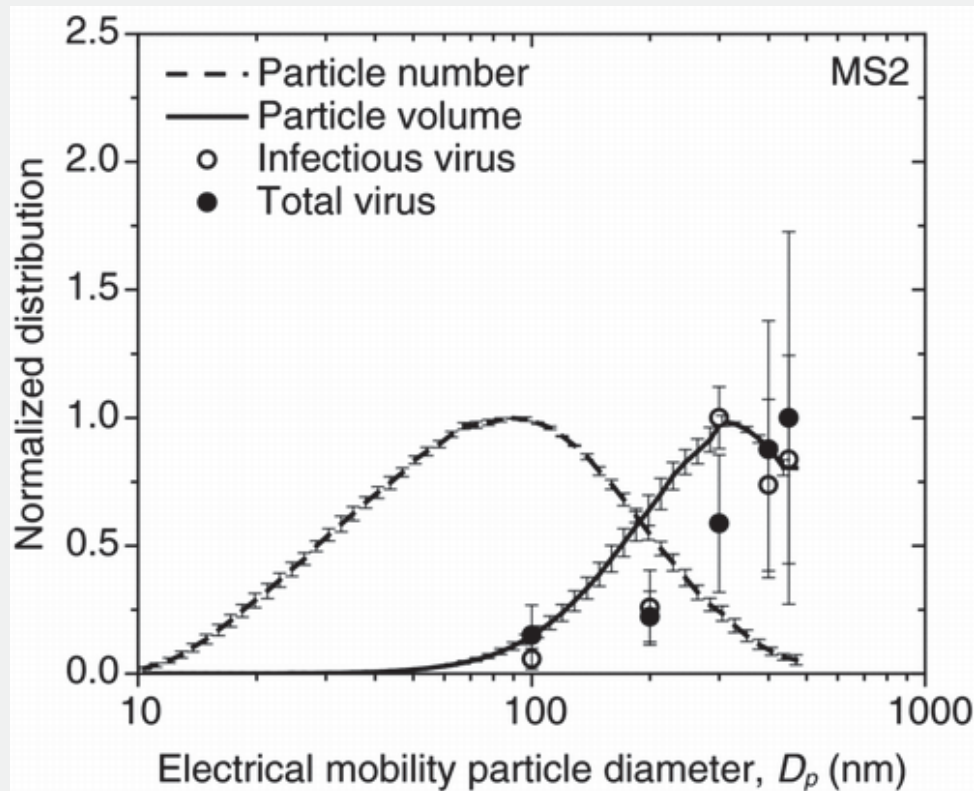
Table adapted from Morawska 2006, with similar numbers reported in the Fiegel 2006 review:

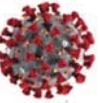
ACTIVITY	NUMBER OF DROPLETS PRODUCED	SMALL (1-2 MM) AEROSOLS?
Normal breathing (5 min)	A few	Some
Single strong nasal exhalation	Few to a few hundred	Some
Counting out loud (talking)	Few dozen to few hundred. Some sources say a few thousand (Xie 2007)	Mostly
Cough	Few hundred to many thousand	Mostly
Sneeze	Few hundred thousand to a few million	Mostly



# Viral Carriers

Particle Size  $\propto$  Viral Carrying Probability



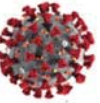


## Airborne?




**Researchers suggest that initial findings indicate airborne isolation precautions are appropriate.**

\* Source: The New England Journal of Medicine, authored by scientist from National Institute of Health, CDC, UCLA, and Princeton University.



## Airborne Precautions

**ISOLATION PRECAUTIONS**  
VISITORS - REPORT TO NURSES' STATION BEFORE ENTERING ROOM

			
<b>WASH HANDS BEFORE and AFTER patient care.</b>	<b>MASKS &amp; PROTECTIVE EYEWEAR or FACE SHIELD</b>	<b>GLOVES</b>	<b>GOWN</b>
	<input type="checkbox"/> Yes, if splashing is likely. <input type="checkbox"/> Yes, for all persons entering room.	<input type="checkbox"/> Yes, when touching blood or body fluids. <input type="checkbox"/> Yes, for all persons entering room.	<input type="checkbox"/> Yes, if soiling is likely. <input type="checkbox"/> Yes, for all persons entering room.

**Personal Protection Equipment**

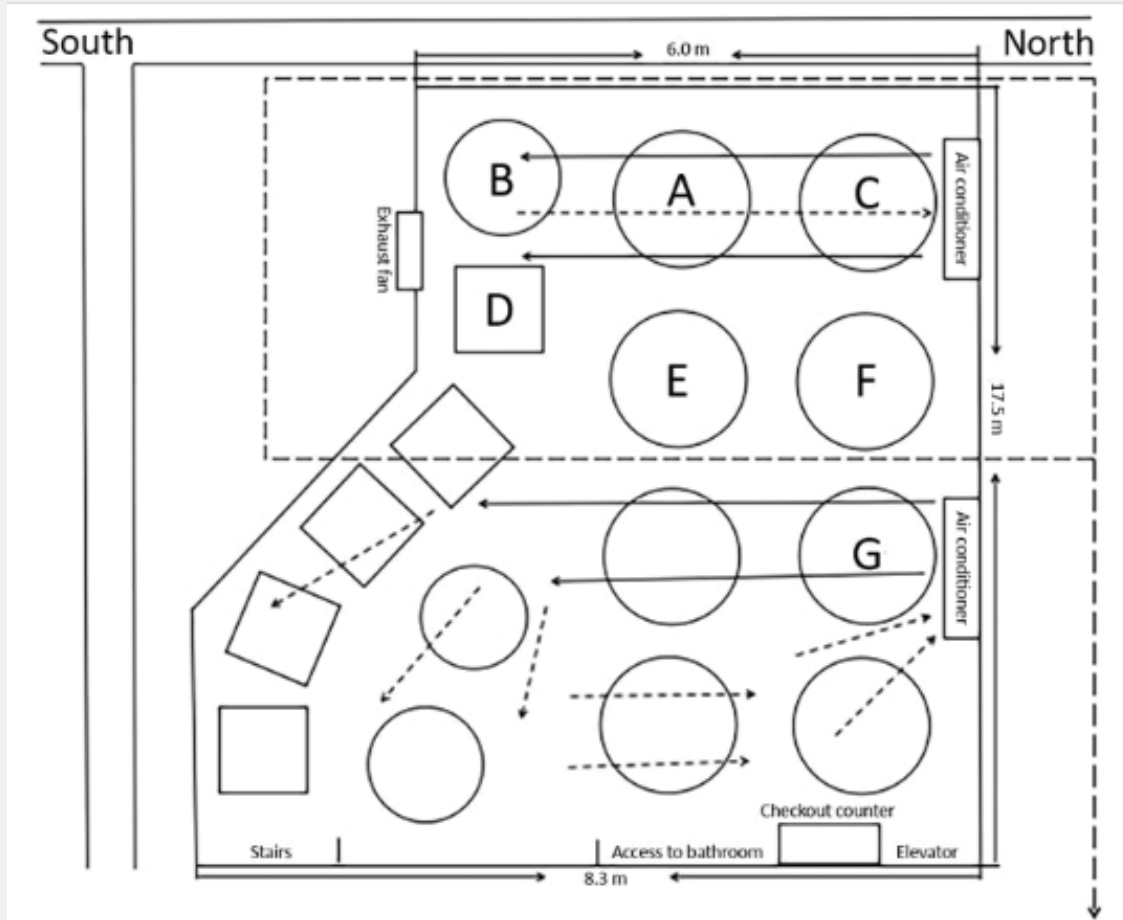


**Enhanced Air Filtration**



**Adjusting Pressure and Air Changes**

# HVAC System Operational Assumptions



# HVAC System Operational Assumptions

## STUDY SHOWS CORONAVIRUS SPREAD IN RESTAURANT

SOURCE: JIANYUN LU, JIENI GU, KUIBIAO LI, CONGHUI XU, WENZHE SU, ZHISHENG LAI, DEQIAN ZHOU, CHAO YU, BIN XU, AND ZHICONG YANG

**RED CIRCLES**  
FUTURE CASE-PATIENTS

**YELLOW-FILLED CIRCLE**  
PRIMARY CASE-PATIENT

### CORONAVIRUS PANDEMIC

GLOBALLY

TOTAL CASES  
**2,611,182**

DEATHS  
**181,235**

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IN THE UNITED STATES

TOTAL CASES  
**834,858**

DEATHS  
**45,894**

SOURCE: JOHNS HOPKINS UNIVERSITY

CORONAVIRUS PANDEMIC

LAS VEGAS MAYOR PUSHES TO REOPEN CASINOS AMID OUTBREAK

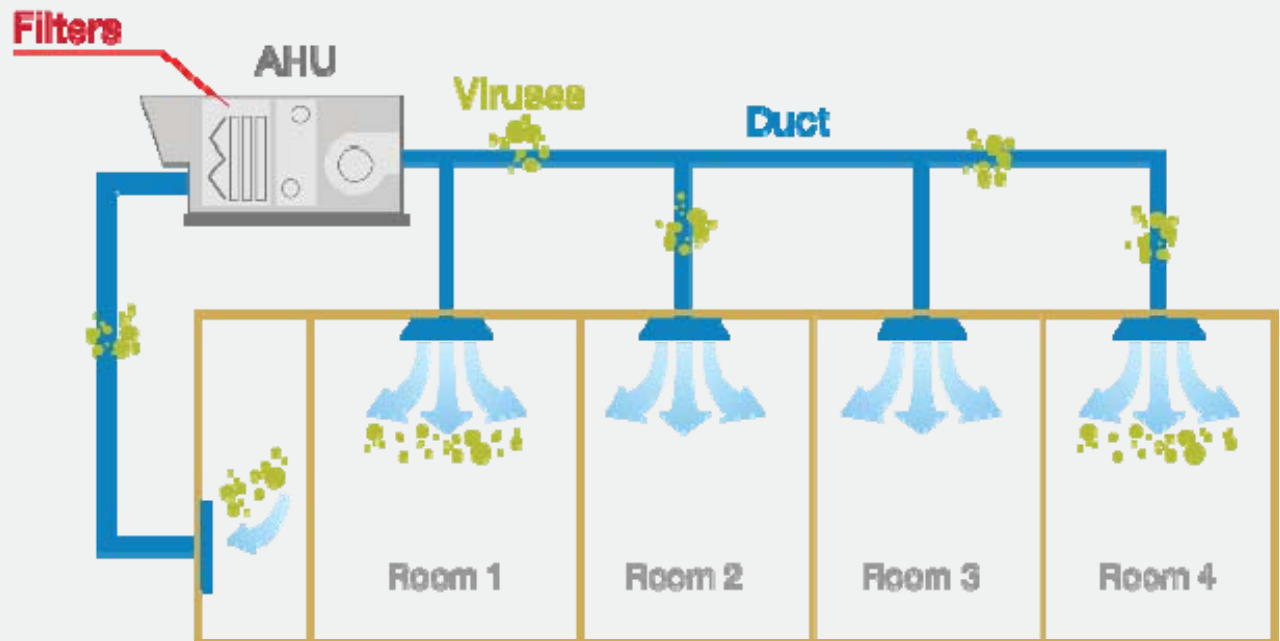
NAS ▲ 254.90

CROW



# HVAC System Operational Assumptions

- HVAC equipment will circulate the air within and between rooms.
- Living viruses can be carried by particles throughout the building via the ductwork.



# What is the Existing Guidance for Current Operation?



## Guidance

1. Government
2. HVAC/Filtration Industry
3. End User Industry Professional Groups

## Government

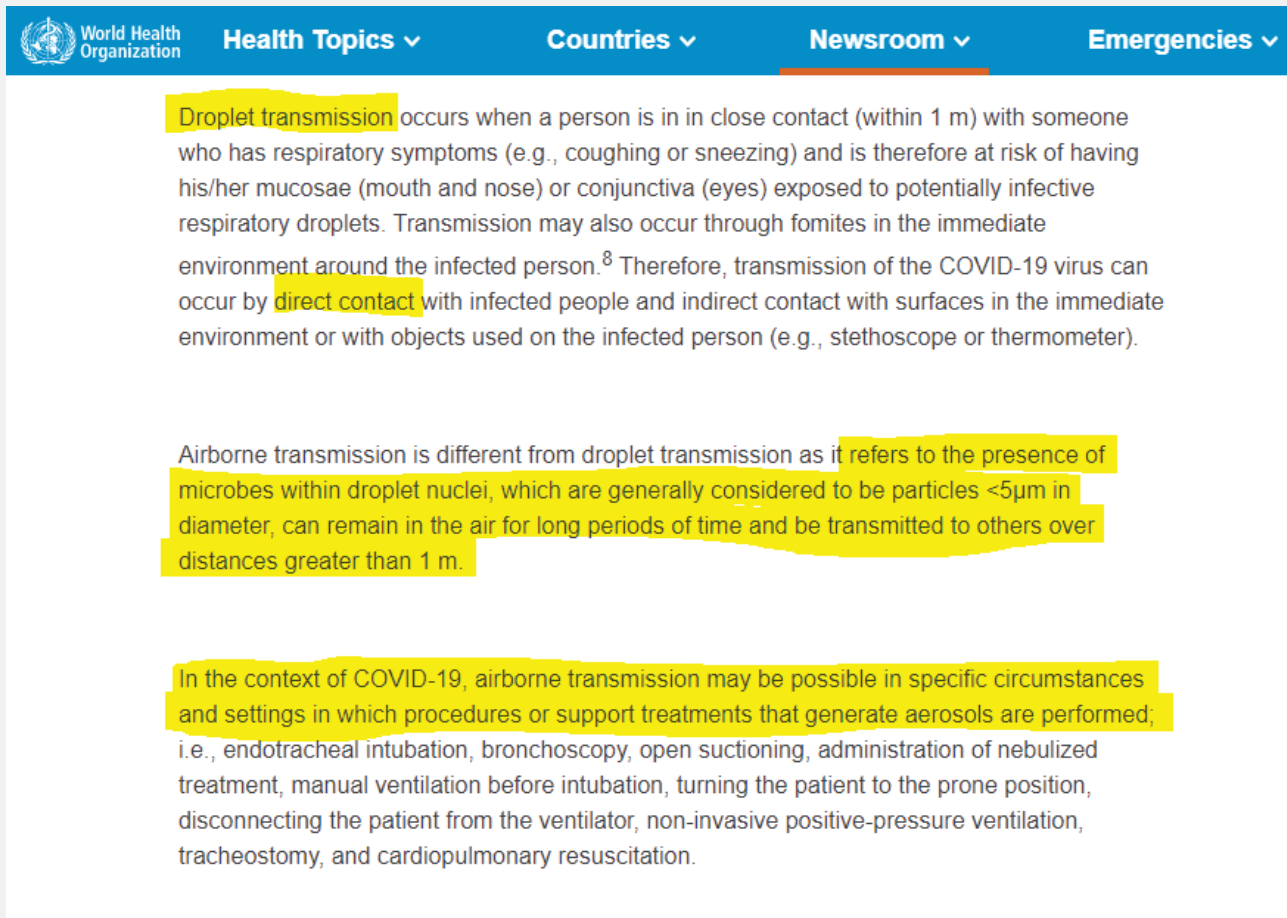
### 1. International/Federal Government Agencies

1. World Health Organization (WHO)
2. Centers for Disease Control (CDC)
3. Occupational Safety and Health Administration (OSHA)

### 2. State/Local Government

1. State Research Institutions
2. Individual Reopening Plans

## WHO



The image is a screenshot of the World Health Organization (WHO) website. At the top, there is a blue navigation bar with the WHO logo and the text "World Health Organization" on the left. To the right of the logo are four menu items: "Health Topics", "Countries", "Newsroom", and "Emergencies", each with a downward-pointing chevron. Below the navigation bar, the main content area is white. The first paragraph describes droplet transmission, stating it occurs within 1 meter of an infected person with respiratory symptoms. The second paragraph explains airborne transmission, noting that it involves particles smaller than 5 micrometers that can stay in the air for long periods. The third paragraph lists specific medical procedures that can generate aerosols, such as endotracheal intubation and bronchoscopy.

**Droplet transmission** occurs when a person is in in close contact (within 1 m) with someone who has respiratory symptoms (e.g., coughing or sneezing) and is therefore at risk of having his/her mucosae (mouth and nose) or conjunctiva (eyes) exposed to potentially infective respiratory droplets. Transmission may also occur through fomites in the immediate environment around the infected person.<sup>8</sup> Therefore, transmission of the COVID-19 virus can occur by **direct contact** with infected people and indirect contact with surfaces in the immediate environment or with objects used on the infected person (e.g., stethoscope or thermometer).

Airborne transmission is different from droplet transmission as it refers to the presence of microbes within droplet nuclei, which are generally considered to be particles <5µm in diameter, can remain in the air for long periods of time and be transmitted to others over distances greater than 1 m.

In the context of COVID-19, airborne transmission may be possible in specific circumstances and settings in which procedures or support treatments that generate aerosols are performed; i.e., endotracheal intubation, bronchoscopy, open suctioning, administration of nebulized treatment, manual ventilation before intubation, turning the patient to the prone position, disconnecting the patient from the ventilator, non-invasive positive-pressure ventilation, tracheostomy, and cardiopulmonary resuscitation.

# CDC - Healthcare

Table 10. Summary of ventilation specifications in selected areas of health-care facilities\*

Specifications	All room (Includes bronchoscopy suites)	PE room	Critical care rooms§	Isolation anteroom	Operating room
Air pressure¶	Negative	Positive	Positive, negative, or neutral	Positive or negative	Positive
Room air changes	≥6 ACH (for existing rooms); ≥12 ACH (for renovation or new construction)	≥12 ACH	≥6 ACH	≥10 ACH	≥15 ACH
Sealed**	Yes	Yes	No	Yes	Yes
Filtration supply	90% (dust-spot ASHRAE 52.1 1992)	99.97% (Fungal spore filter at point of use (HEPA at 99.97% of 0.3 µm particles))	>90%	>90%	90%
Recirculation	No (Recirculated air may be used if the exhaust air is first processed through a HEPA filter.)	Yes	Yes	No	Yes

\* Material in this table is compiled from references 35 and 120.

§ Positive pressure and HEPA filters may be preferred in some rooms in intensive care units (ICUs) caring for large numbers of immunocompromised patients.


¶ Clean-to-dirty: negative to an infectious patient, positive away from an immunocompromised patient.




\*\* Minimized infiltration for ventilation control; pertains to windows, closed doors, and surface joints.

¶¶ Table used with permission of the publisher of reference 35 (Lippincott Williams and Wilkins).

# CDC – Non-Healthcare

## Preparing Workplaces for a COVID-19 Outbreak

Businesses and employers can prevent and [slow the spread of COVID-19](#). Employers should plan to respond in a flexible way to varying levels of disease transmission in the community and be prepared to refine their business response plans as needed. According to the Occupational Safety and Health Administration (OSHA), most American workers will likely experience low (caution) or medium exposure risk levels at their job or place of employment (see [OSHA guidance for employers](#)  for more information about job risk classifications).

Businesses are strongly encouraged to coordinate with [state](#)  and [local](#)  health officials so timely and accurate information can guide appropriate responses. Local conditions will influence the decisions that public health officials make regarding community-level strategies. CDC has [guidance for mitigation strategies](#)  according to the level of community transmission or impact of COVID-19.

All employers need to consider how best to decrease the spread of COVID-19 and lower the impact in their workplace. This may include activities in one or more of the following areas:

- a. reduce transmission among employees,
- b. maintain healthy business operations, and
- c. maintain a healthy work environment.

# OSHA

## ***Engineering Controls***

Engineering controls involve isolating employees from work-related hazards. In workplaces where they are appropriate, these types of controls reduce exposure to hazards without relying on worker behavior and can be the most cost-effective solution to implement. Engineering controls for SARS-CoV-2 include:

- Installing high-efficiency air filters.
- Increasing ventilation rates in the work environment.
- Installing physical barriers, such as clear plastic sneeze guards.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

1 2

- Installing a drive-through window for customer service.
- Specialized negative pressure ventilation in some settings, such as for aerosol generating procedures (e.g., airborne infection isolation rooms in healthcare settings and specialized autopsy suites in mortuary settings).

## Professional Groups

1. Consulting Engineers
2. International Facility Management Association (IFMA)
3. American Society for Healthcare Engineering (ASHE)
4. Building Owners and Managers Association (BOMA)
5. Leadership in Educational Facilities (APPA)

# IFMA/C&W

## **BUILDING SYSTEMS: HVAC AND MECHANICAL**

Building employees responsible for assessing the physical structure and building systems should refer to all Authority Having Jurisdiction.

- Air filters should be replaced after flushing the building. Refer to manufacturers' recommendations and guidance for filter selection. Use the highest efficiency rated filter recommended/allowed by the manufacturer (MERV rating) and reference any WHO guidelines
- When replacing air filters (including HEPA filters):
  - Use proper safety procedures and PPE
  - Avoid hitting, dropping, or shaking the filter
  - Do not use compressed air to clean a filter, which could allow materials in the filter to become airborne
  - Properly dispose of used filters and PPE/gloves in a sealed plastic bag
  - Clean hands when the task is finished
  - Minimize exposure to building interior areas when removing old filters from the site.
    - » Recommended approach: transport to a waste collection area without entering the building
    - » Alternative approach: if it's impossible to dispose of the filter without transporting through the building, choose routes that minimize exposure to normally occupied areas, including freight elevators and minimally used support space



# BOMA

## Mechanical Systems (HVAC, Plumbing, Water, Elevator)

### HVAC

- During low- or no-occupancy and prior to building re-entry, run HVAC equipment in building and tenant spaces on at least a reduced—if not regular—schedule.
- Continue normal and regular HVAC maintenance, including filter changes. Check with your building engineers and HVAC contractor for any other recommended maintenance, changes in maintenance schedules, or filter or system upgrades or changes.
- If possible, consider increasing exhaust and infusion of outside air for re-entry and perhaps for several weeks following re-entry.
- Consult ASHRAE guidelines for operating heating, ventilating, and air conditioning systems to reduce COVID-19 transmission and follow CDC guidance where applicable.

## HVAC/Filtration Industry

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
2. National Air Filtration Association (NAFA)
3. Product & Service Suppliers

# ASHRAE

## 4.1 ASHRAE's Positions

- HVAC design teams for facilities of all types should follow, as a minimum, the latest published standards and guidelines and good engineering practice. Based on risk assessments or owner project requirements, designers of new and existing facilities could go beyond the minimum requirements of these standards, using techniques covered in various ASHRAE publications, including the ASHRAE Handbook volumes, Research Project final reports, papers and articles, and design guides, to be even better prepared to control the dissemination of infectious aerosols.
- Mitigation of infectious aerosol dissemination should be a consideration in the design of all facilities, and in those identified as high-risk facilities the appropriate mitigation design should be incorporated.
- The design and construction team, including HVAC designers, should engage in an integrated design process in order to incorporate the appropriate infection control bundle in the early stages of design.
- Based on risk assessments, buildings and transportation vehicles should consider designs that promote cleaner airflow patterns for providing effective flow paths for airborne particulates to exit spaces to less clean zones and use appropriate air-cleaning systems. (Evidence Level A)
- Where a significant risk of transmission of aerosols has been identified by infection control risk assessments, design of AIRs should include anterooms. (Evidence Level A)

# ASHRAE

- Based on risk assessments, the use of specific HVAC strategies supported by the evidence-based literature should be considered, including the following:
  - **Enhanced filtration** (higher minimum efficiency reporting value [MERV] filters **over code minimums** in occupant-dense and/or higher-risk spaces) (Evidence Level A)
  - Upper-room UVGI (with possible in-room fans) as a supplement to supply airflow (Evidence Level A)
  - Local exhaust **ventilation** for source control (Evidence Level A)
  - Personalized ventilation systems for certain high-risk tasks (Evidence Level B)
  - **Portable, free-standing high-efficiency** particulate air (HEPA) filters (Evidence Level B)
  - **Temperature** and **humidity** control (Evidence Level B)

# ASHRAE- Healthcare

- Healthcare buildings<sup>8</sup> should consider design and operation to do the following:
  - Capture expiratory aerosols with headwall exhaust, tent or snorkel with exhaust, floor-to-ceiling partitions with door supply and patient exhaust, local air HEPA-grade filtration.
  - Exhaust toilets and bed pans (a must).
  - Maintain temperature and humidity as applicable to the infectious aerosol of concern.
  - Deliver clean air to caregivers.
  - Maintain negatively pressurized intensive care units (ICUs) where infectious aerosols may be present.
  - Maintain rooms with infectious aerosol concerns at negative pressure.
  - Provide 100% exhaust of patient rooms.
  - Use UVGI.
  - Increase the outdoor air change rate (e.g., increase patient rooms from 2 to 6 ach).
  - Establish HVAC contributions to a patient room turnover plan before reoccupancy.

## ASHRAE- Non-Healthcare

- Non-healthcare buildings should have a plan for an emergency response. The following modifications to building HVAC system operation should be considered:
  - Increase outdoor air ventilation (disable demand-controlled ventilation and open outdoor air dampers to 100% as indoor and outdoor conditions permit).
  - Improve central air and other HVAC filtration to **MERV-13 (ASHRAE 2017b) or the highest level achievable.**
  - Keep systems running longer hours (24/7 if possible).
  - Add **portable room air cleaners** with HEPA or high-MERV filters with due consideration to the clean air delivery rate (AHAM 2015).
  - Add duct- or air-handling-unit-mounted, upper room, and/or portable UVGI devices in connection to in-room fans in high-density spaces such as waiting rooms, prisons, and shelters.
  - Maintain temperature and humidity as applicable to the infectious aerosol of concern.
  - Bypass energy recovery ventilation systems that leak potentially contaminated exhaust air back into the outdoor air supply.

# Should Filters be Changed Right Now?

If there are system issues or you are upgrading efficiency.

## Not if it is the same MERV...



1. Not Essential (Short Term)
2. Dirtier filters can have better efficiency
3. Filters in recently occupied spaces can be contaminated
4. Avoid Filter Fever



## Exceptions

1. Pressure
2. Flow
- 3. Improve Efficiency**

If you do need to change a filter, use PPE



# Protective Equipment

THERE IS AND ALWAYS WAS A RISK WHEN REPLACING POTENTIALLY CONTAMINATED FILTERS.

Suitable protection when changing out dust loaded filters is **ALWAYS RECOMMENDED**



+



+



**Suitable Facemask**  
classified at least  
FFP 3, ideally with  
eye protection

**Rubber  
gloves**

**Protection suits**  
give best possible  
protection.



Should Filters be Changed  
Before Coming Back to Work?

Absolutely, and the sooner you  
place the order better.

## Even if you don't upgrade?

1. Air Flow
2. Air Quality
3. Energy Savings

\* When you change filters, USE PPE!!!!\*



How is the Market Responding?

## Early Market Trends

1. Most Facilities Want to Improve Air Filtration
  - Occupant Safety
  - Occupant Peace of Mind
  - Business Case: Occupant Satisfaction
  - Business Case: Liability and Risk Mitigation
2. Requesting Highest Possible Efficiencies

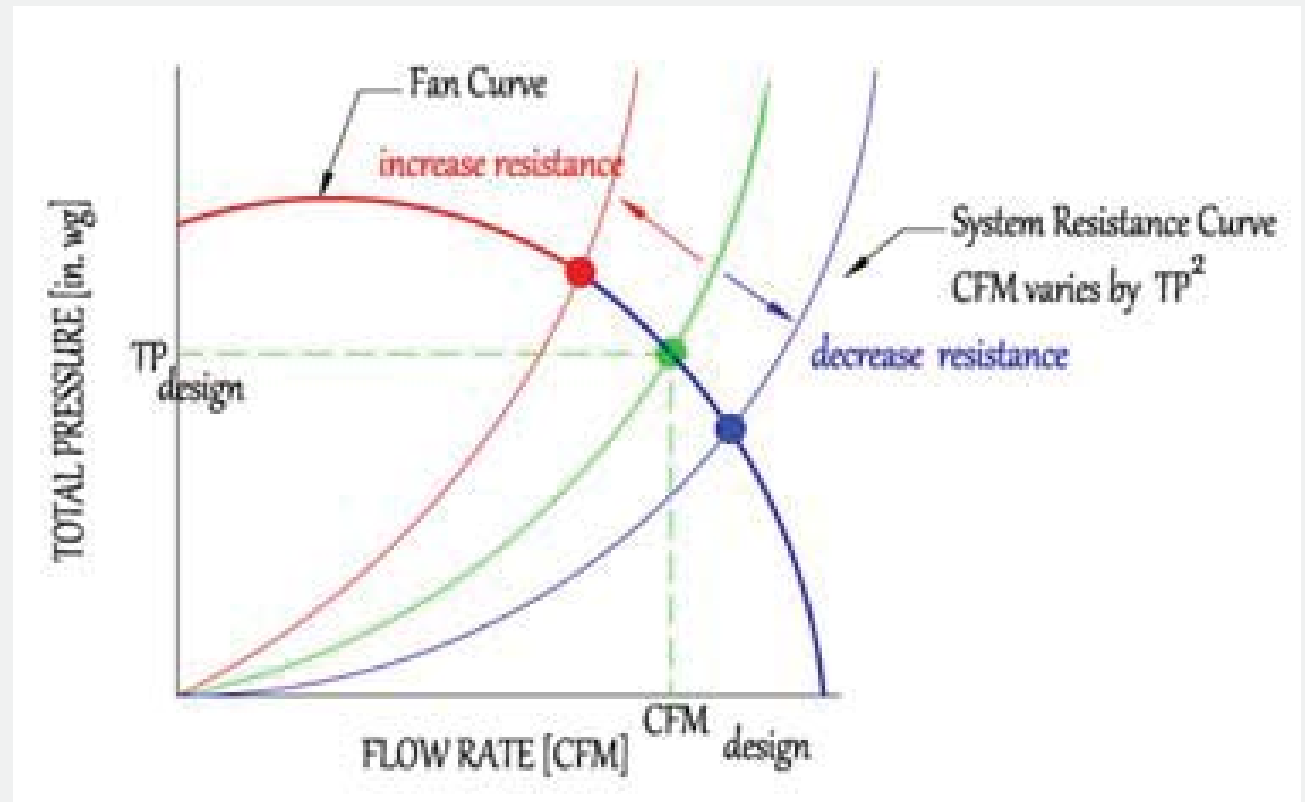
Is it Possible to Upgrade from  
Current Filtration Methods?

Most Likely.

## Determining Factors: Fan

1. Check fan curve documentation
2. Verify HVAC pressure and flow specifications

\*Contact AAF Flanders or HVAC manufacturer representative for additional assistance





## Determining Factors: Frame

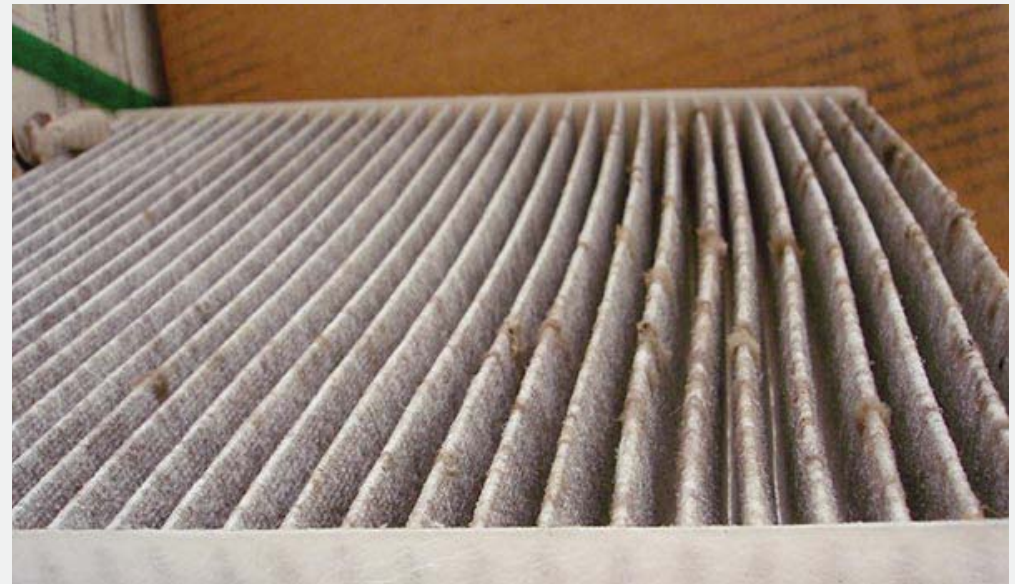
1. Confirm adequate sealing
2. Determine proper size and depth possibilities
3. Plan for enough clearance upstream and downstream of filters



## Determining Factors: Environment

Ensure that all specialty environmental needs are satisfied:

1. Temperature → High Temp Filter
2. Moisture → Wire Back
3. UV Lighting → Durable Materials
4. Biological Concerns → Antimicrobial Treatment



## Determining factors: Bypass

**A filter is only as good as the air flowing around it!**

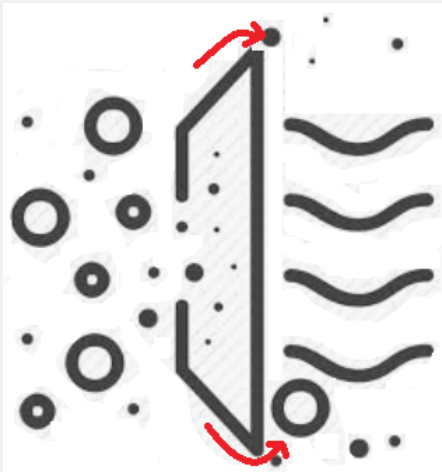


- A 1 mm gap in the installation of a MERV 15 filter can reduce its efficiency to MERV 14\*
- A 10 mm gap (less than 1/4") can drop a filter's MERV rating by 2 levels\*
- Higher efficiency filters → Higher pressure drop  
→ More adversely effected by bypass

\* Source: NAFA website.

## Determining factors: Bypass

### Filter Frame Maintenance Tips



- Ensure all filter fasteners are used correctly and placed securely during installation
- Inspect & ID potential points of bypass due to damage or space between components
- Install all small metal block offs if needed
- Use caulk, gasketing, and tape to create airtight seals

## Determining factors: Bypass

Looks in the spaces between:

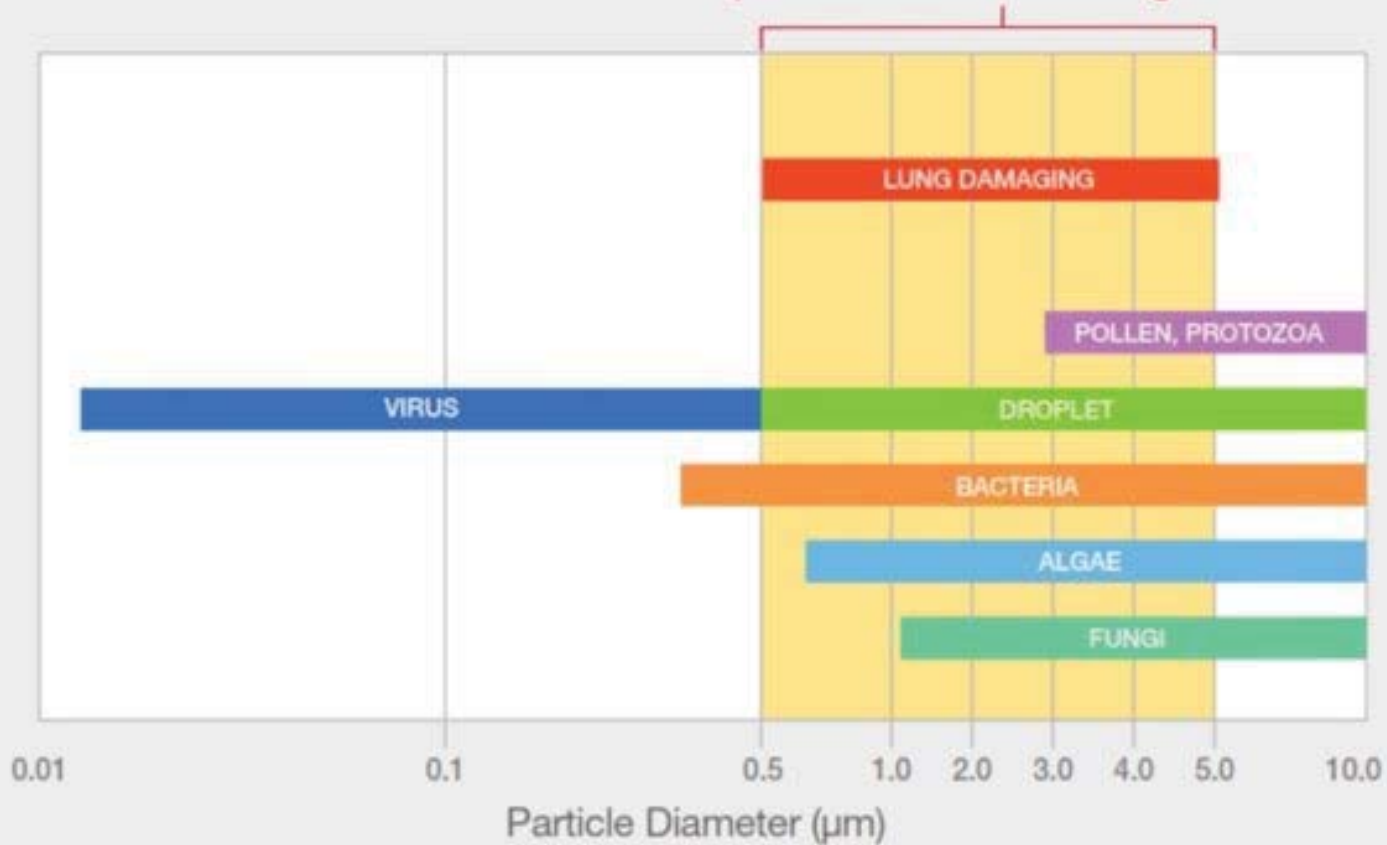
- \_ Damaged filter (front access) frames or (side access) channels
- \_ Edges of block offs and filter housings
- \_ Individual frames
- \_ Filters and channels/tracks
- \_ Individual filters within channels
- \_ Perimeter of filter housing and air handler walls
- \_ Perimeter of filter housing and access doors

## Which Upgrade Option is Best?

Depends on HVAC system specifications & desired air quality.

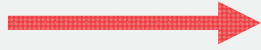
# Understanding particle size

Bioaerosols are airborne in moisture droplets of .5 microns or larger



## MERV

MERV Rating	Air Filter will trap Air Particles size .03 to 1.0 microns	Air Filter will trap Air Particles size 1.0 to 3.0 microns	Air Filter will trap Air Particles size 3 to 10 microns	Filter Type ~ Removes These Particles
MERV 1	< 20%	< 20%	< 20%	Fiberglass & Aluminum Mesh ~ Pollen, Dust Mites, Spray Paint, Carpet Fibres
MERV 2	< 20%	< 20%	< 20%	
MERV 3	< 20%	< 20%	< 20%	
MERV 4	< 20%	< 20%	< 20%	
MERV 5	< 20%	< 20%	20% - 34%	Cheap Disposable Filters ~
MERV 6	< 20%	< 20%	35% - 49%	
MERV 7	< 20%	< 20%	50% - 69%	Mold Spores, Cooking Dusts, Hair Spray, Furniture Polish
MERV 8	< 20%	< 20%	70% - 85%	
MERV 9	< 20%	Less than 50%	85% or Better	Better Home Box Filters ~
MERV10	< 20%	50% to 64%	85% or Better	
MERV 11	< 20%	65% - 79%	85% or Better	Lead Dust, Flour, Auto Fumes, Welding Fumes
MERV 12	< 20%	80% - 90%	90% or Better	
MERV 13	Less than 75%	90% or Better	90% or Better	Superior Commercial Filters ~
MERV 14	75% - 84%	90% or Better	90% or Better	
MERV 15	85% - 94%	95% or Better	90% or Better	Bacteria, Smoke, Sneezes
MERV 16	95% or Better	95% or Better	90% or Better	
MERV 17	99.97%	99% or Better	99% or Better	HEPA & ULPA ~ Viruses, Carbon Dust, <.30 pm
MERV 18	99.997%	99% or Better	99% or Better	
MERV 19	99.9997%	99% or Better	99% or Better	
MERV 20	99.99997%	99% or Better	99% or Better	





# Best Filtration Mitigation Strategy

## HEPA/ULPA Filtration Systems Considerations

- Do you have enough fan static pressure?
- Are current housings acceptable?
- Will the filter fit?
- Can new housings be added?
- Is it accessible? serviceable?
- Is there a need somewhere in the system other than the air handler?



AstroCel® I

AstroPak®



# MERV 16 Upgrade Considerations

Similar to HEPA/ULPA

- Can the system handle the change?
- What style will work best?
- What sizes will fit best?
- Are different sizes or block offs needed?
- Are filter housings required outside of the air handler?



BioCel® VXL

BioCel® M-Pak



# Quickest Filtration Mitigation Strategy

Upgrade to Higher ASHRAE MERV Filters in Existing Racks

When considering aerosolized respiratory droplets sized 0.5  $\mu\text{m}$  to 5.0  $\mu\text{m}$ , the ASHRAE 52.2 MERV rating chart illustrates the improving % efficiency with any improvement over MERV 8.

Particle Size Range	Minimum Efficiency %								
	MERV 8	MERV 9	MERV 10	MERV 11	MERV 12	MERV 13	MERV 14	MERV 15	MERV 16
0.3 - 1.0 $\mu\text{m}$	N/A	N/A	N/A	N/A	N/A	$E_1 < 75\%$	$75\% \leq E_1 < 85\%$	$85\% \leq E_1 < 95\%$	$E_1 \geq 95\%$
1.0 - 3.0 $\mu\text{m}$	N/A	$E_2 < 50\%$	$50\% \leq E_2 < 65\%$	$65\% \leq E_2 < 80\%$	$E_2 \geq 80\%$	$E_2 \geq 90\%$	$E_2 \geq 90\%$	$E_2 \geq 90\%$	$E_2 \geq 95\%$
3.0 - 10.0 $\mu\text{m}$	$E_3 \geq 70\%$	$E_3 \geq 85\%$	$E_3 \geq 85\%$	$E_3 \geq 85\%$	$E_3 \geq 90\%$	$E_3 \geq 90\%$	$E_3 \geq 90\%$	$E_3 \geq 90\%$	$E_3 \geq 95\%$

## Recommendations: Healthcare

1. Minimum MERV 14-16 final filtration
2. Minimum HEPA filtration for any high-risk areas
3. HEPA filtration as final filtration in all areas where possible
4. Change/Add ASHRAE or HEPA housing to upgrade if needed
5. HEPA Recirculation units in treatment areas
6. Considering adding Ultraviolet C-wave (UVC) Lights

## Recommendations: Commercial Single Stage

1. **MINIMUM** MERV 13 pleated filtration
2. MERV 14-16 bag or box filtration **preferred** if possible
3. Determine best option based on available space and potential risk



PREpleat® M13

## Recommendations: Commercial Multi-Stage

1. **MINIMUM** MERV 13 final filtration
2. MERV 14-16 bag or box final filtration **preferred** if possible
3. MERV 11 prefiltration to preserve final filter life



MEGApleat® M9



DriPak NX

# How Will Covid-19 Affect the Future of Filtration?

## Shift From Occupant Comfort to Life Safety

- Higher Filter Efficiencies
- Pivotal Event For New Building Design
- Retrofits Driven by End Users
- Occupied Space Equipment Additions
- Non-Filter Solutions



## Non-Filter Solutions

- Humidity Control
- Increase in Ventilation
- Suggested Air Changes
- UV Lighting
- Ion Generation
- Electrostatic Precipitators



## Change Consequences

- Decreased Occupancy
- Increased Air Quality Assurance Cost
- Increased Air Changes
- Increased Energy Consumption



## Industry Reaction

- Increased Overall Demand
- Supply Chain
- Leadtime



# Which AAF Flanders Product Option is Best for Your Facility?

## We Can Help You Decide

- Contact your local AAF Flanders representative to schedule a time for a comprehensive filtration audit
- The Filter Shop
- [sales@thefiltershopinc.com](mailto:sales@thefiltershopinc.com)
- 402-597-1988