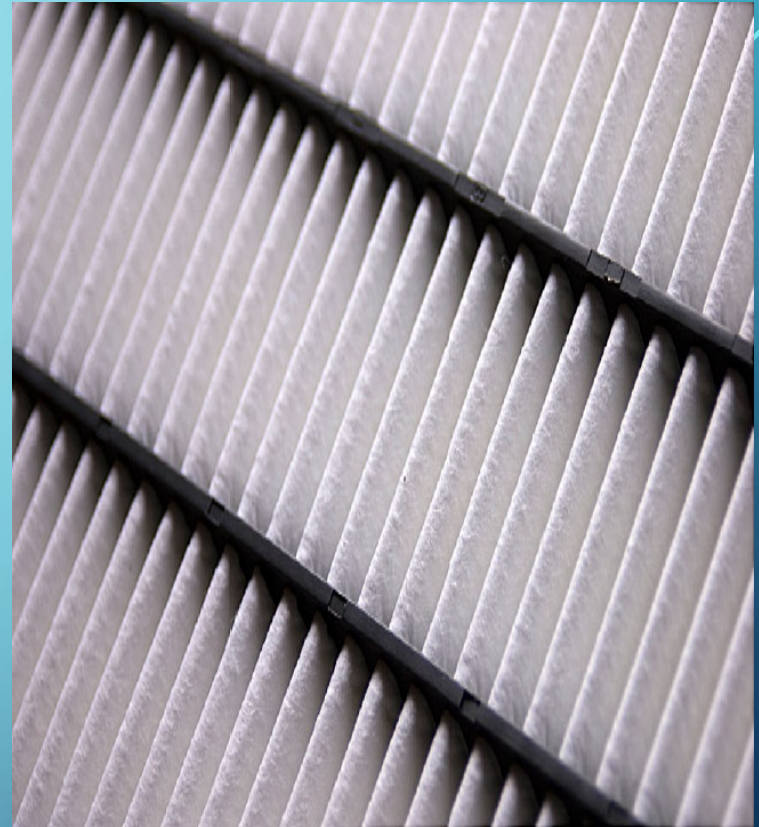


AIRBORNE VIRUSES & THE USE OF HIGH EFFICIENCY PARTICULATE AIR (HEPA) FILTRATION



EHA CONSULTING GROUP, INC.

Melvin N. Kramer, Ph.D., M.P.H.

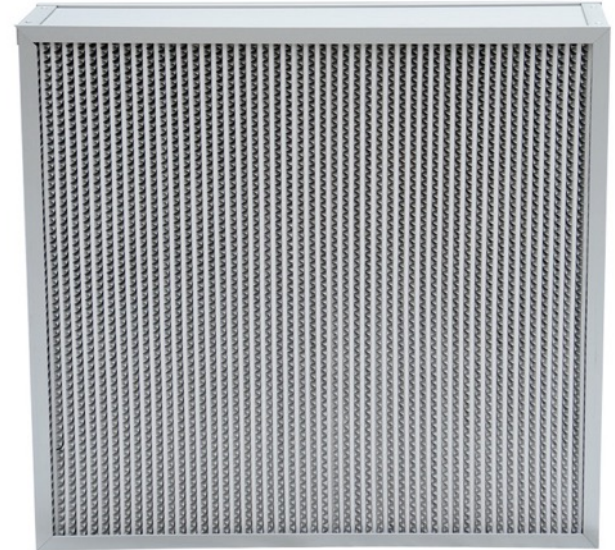
Founder & CEO

www.ehagroup.com

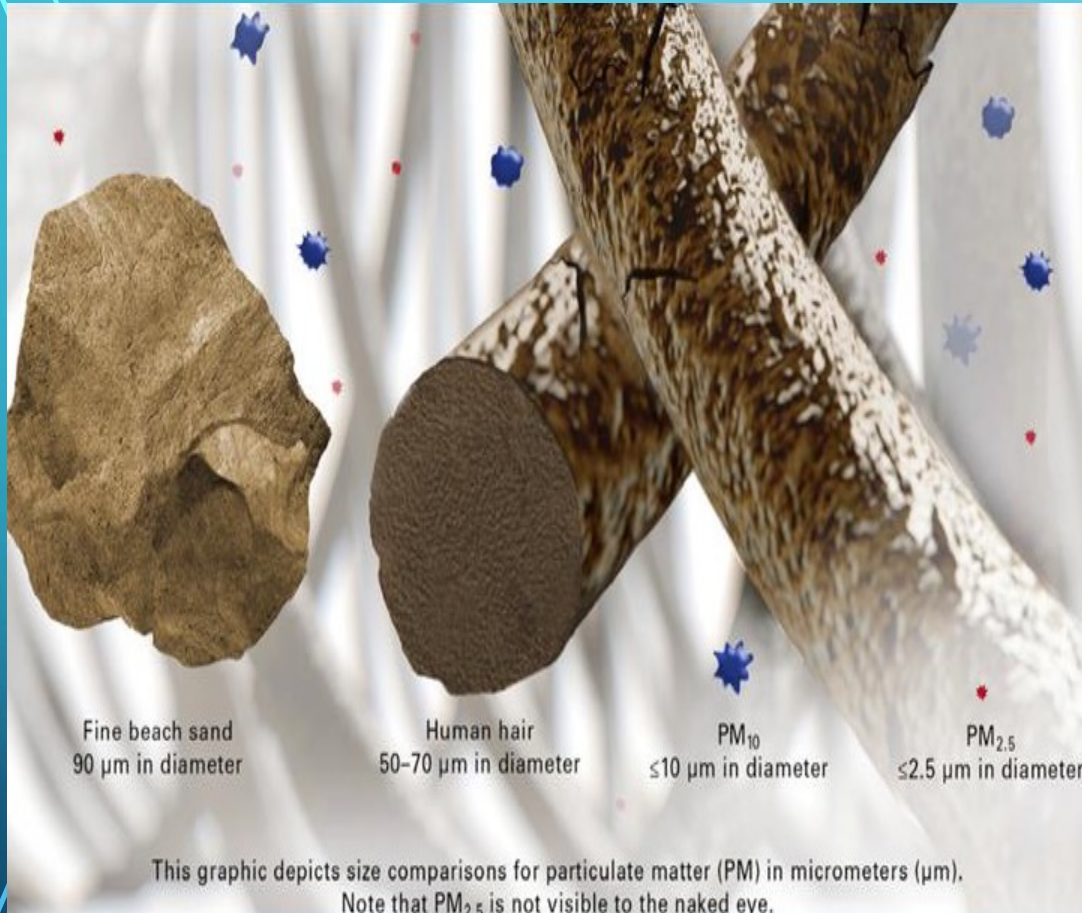
June 16, 2020

WHAT DOES HEPA MEAN?

- HEPA stands for High Efficiency Particulate Air
- A HEPA filter must capture at least 99.97% of particles larger than $0.3\ \mu\text{m}$ (or 0.3 microns) to meet the standard of efficiency set by the United States Department of Energy (DOE)



WHY 0.3 MICRONS?



- The micron size 0.3 is referred to by scientists as the MPPS, or the most penetrating particle size
- Scientists have found that particles of that size evade air filters more than larger or smaller particles

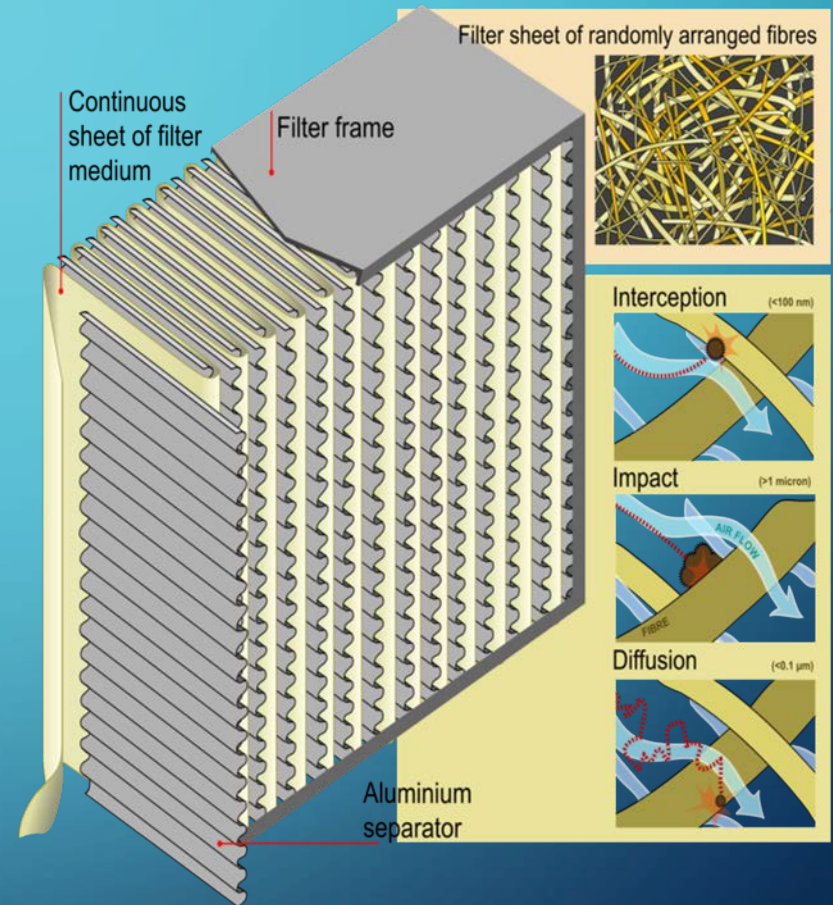
WHAT ARE HEPA FILTERS MADE FROM AND HOW DO THEY WORK?

- HEPA filters typically involve a pleated sheet of randomly arranged fiberglass fibers with diameters between 0.5- 2 micrometers
- A motorized fan passes air through the filter. Particles are trapped when they adhere to the fibers or become embedded in them
- The smallest particles, including viruses, collide with gas molecules. These collisions slow the passage of those particles through the filter and increase their likelihood of becoming trapped



TRUE HEPA

- A filter's efficiency refers to how many particles are trapped and removed from the airflow passing through the filter
- True HEPA filtration captures smoke, dust, pollen, pet hair and dander, mold spores and dust mites



CAUTION: HEPA TYPE AND HEPA LIKE

- Filters labeled "HEPA-type" or "near HEPA." Unlike True HEPA, "HEPA Type" and "HEPA Like" filters fail the DOE standard
- These terms are essentially meaningless and are used in order to confuse consumers into purchasing lower quality filters and air purifiers
- These filters are less dense and thus unable to trap the smallest and most harmful particles

HEPA FILTER EFFICIENCY

Type	Filter-Class	Efficiency% .01 microns	Penetration% .01 microns
HEPA	H10	85%	15%
HEPA	H11	95%	5%
HEPA	H12	99.5%	0.5%
HEPA	H13	99.95%	0.05%
HEPA	H14	99.995%	0.005%

WHERE ARE HEPA FILTERS USED?



- HEPA filters can greatly restrict the spread of airborne fungi, viruses, and bacteria
- HEPA filters are used in applications that require contamination control, such as the manufacturing of disk drives, medical devices, semiconductors, nuclear, food and pharmaceutical products
- HEPA filters are also used in hospitals, home, vehicles, aircrafts

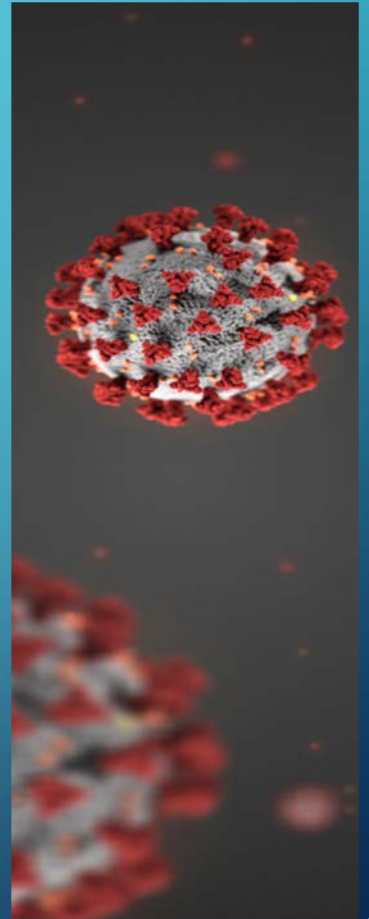
MEDICAL GRADE HEPA FILTERS



- Although there are not different *types* of HEPA – as filters either meet or fail the HEPA standard – there are different levels of HEPA efficiency
- True HEPA generally ranges from H10-H12. This is the “grade” of HEPA or the level of efficiency. The higher the grade, the better the filter
- HEPA H13-H14 are within the highest tier of HEPA and are considered medical grade quality

CORONAVIRUS (SARS-COV-2)

- The size of the SARS-CoV-2 virus is 0.125 microns. A True HEPA filter can only remove particles as small as 0.3 microns
- To ensure particles the size of the SARS-CoV-2 are filtered out, a medical-grade HEPA filter is required
- Medical grade HEPA filters with the highest classification of H13 - H14



NEW SAFETY MEASURES IN CRUISE SHIPS

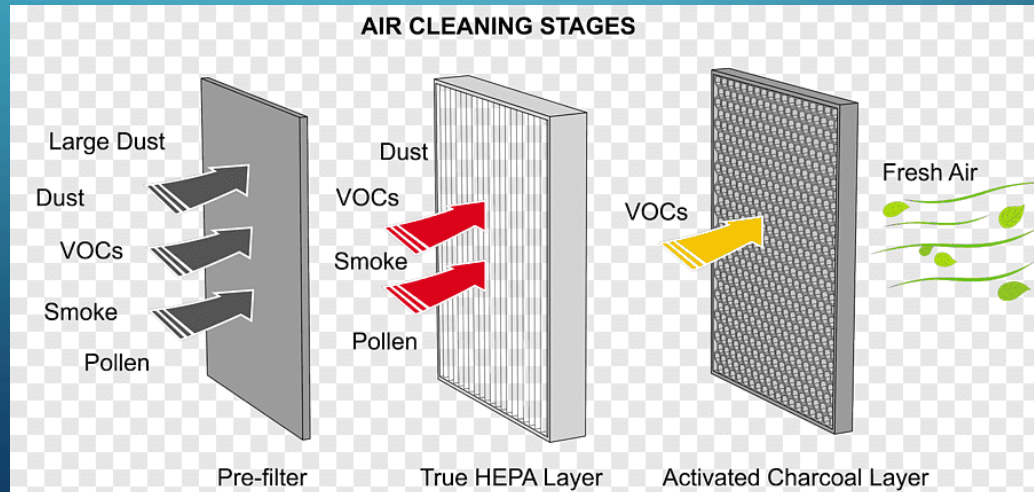


- New coronavirus-prompted health and safety measures will be in place once cruise ships resume operations
- SOME cruise lines are implementing fleetwide safety measures, which include replacing existing air filters with medical-grade, H13 HEPA air-filters

OTHER AIR CLEANING PROCESSES

Air-purifying systems equipped with a HEPA filter trap particles but do not dispose of them. Thus, HEPA systems usually employ other processes as well to complete their work, such as high-energy ultraviolet light and activated carbon

- High-energy ultraviolet light is used for degrading bacteria and viruses, with a fan or other forced-air system to ensure that the air passes through the filter
- Activated carbon is often used to adsorb small volatile chemical molecules, converting them to a solid state from a gaseous one. Activated carbon helps with odor control



ULTRAVIOLET LIGHT IN HEPA AIR FILTRATION DEVICES?

- The prominent method used in healthcare facilities installs ultraviolet germicidal irradiation (UVGI) lamps in HVAC exhaust or supply ducts. It's very effective with nearly 100% of the air being irradiated
- Centers for Disease Control and Prevention (CDC) does not recommend the use of UVGI inside HEPA filtration systems
- CDC does suggest using HEPA air filtration *in conjunction* with properly installed UVGI equipment

WHAT ARE THE MAJOR DRAWBACKS AND POTENTIAL HAZARDS OF USING UV-C INSIDE A HEPA FILTRATION DEVICE?

- The effectiveness of UVGI can change and be potentially hazardous when used inside a HEPA filtration device
- UV-C Bulbs Often Contain Mercury
- UV-C bulbs can produce ozone (O₃) as it interacts with the air, which is dangerous
- Cheaply made bulbs or unregulated companies in foreign countries could be supplying a potentially dangerous product if not FDA approved



INSTALLING HEPA FILTRATION IN EXISTING HVAC SYSTEMS

- According to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) the filtration provided by HVAC systems can reduce the airborne concentration of the virus and reduce the risk of transmission of viruses through the air
- ASHRAE recommends increasing the level of filtration efficacy, if possible
- When increasing filter efficiency, HVAC operators must ensure the HVAC unit can overcome any pressure drop caused by the new filters to maintain proper airflow throughout the system

PORTABLE AIR CLEANERS

- According to the National Air Filtration Association, there is no direct clinical evidence of the benefit of portable air cleaners for reducing infectious disease risk, but some benefit can be reasonably inferred for appropriately sized, maintained, and operated portable HEPA filters
- Efficiency and airflow rate of the air cleaner, sizing and placement within the space, maintenance and filter change, nature of space that is being cleaned are all important factors
- The Environmental Protection Agency says portable filtration is likely somewhat effective in concert with other control measures





Thank you!

Please visit us on www.ehagroup.com where we will be posting updated and pertinent information