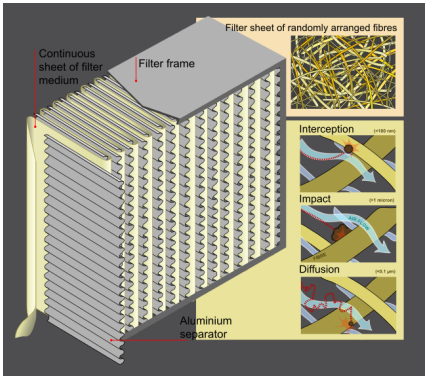
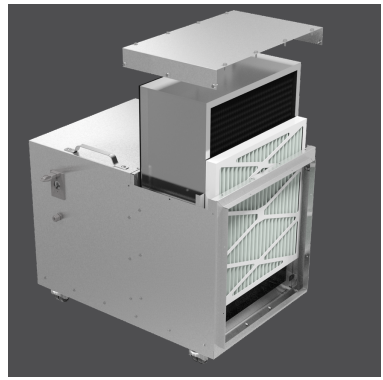
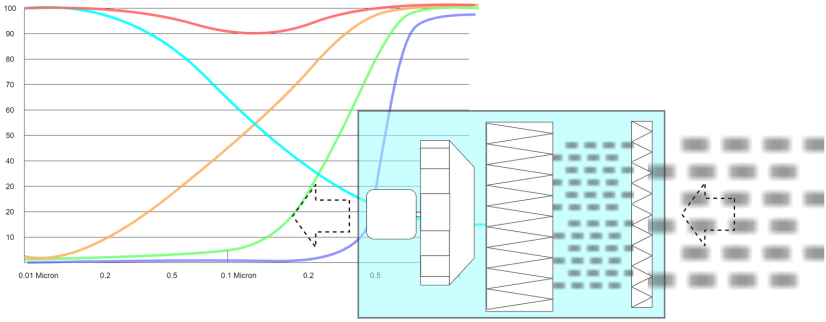
# REDUCING RISKS ASSOCIATED WITH AIRBORNE VIRUSES COVID 19



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**Reducing Risks Associated with Airborne Viruses – COVID 19**

Harvard School for Public Health recently published guidelines for reducing risk of the spread of airborne viruses for schools. The recommendations are for schools to adapt and implement while reopening this fall. The approach was developed by a team focused on helping schools prioritize actions that will provide the most benefit.

These guidelines focus on four key areas: Classrooms; Buildings; Building Systems; Policies, Schedules and Activities.

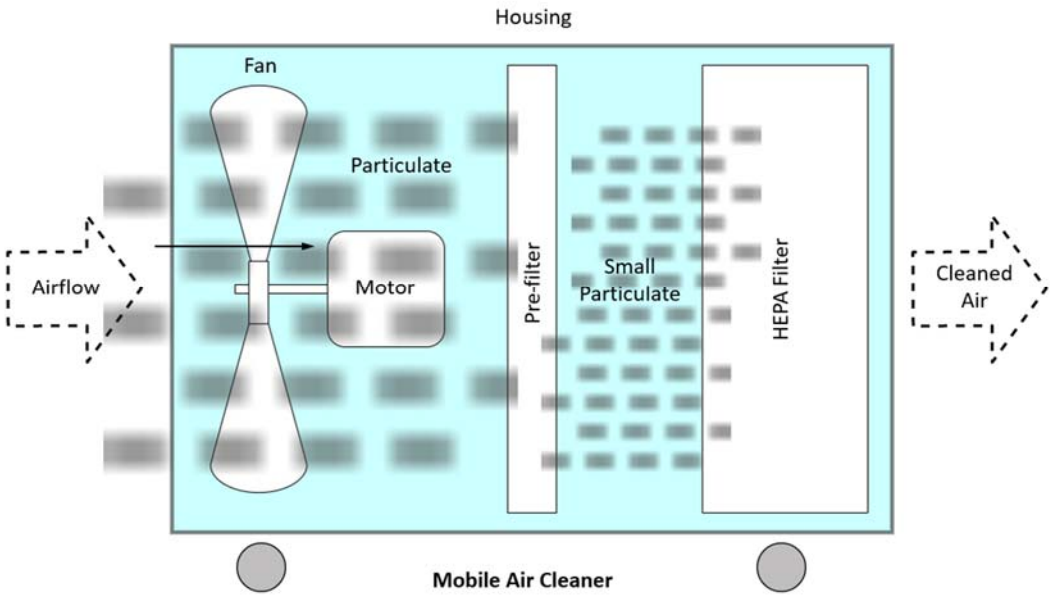
Focusing on the Building Systems section, the suggested Ventilation Strategy has four key pieces:

*#1 - Increase outdoor air ventilation*
*#2 - Filter indoor air*
*#3 - Supplement with portable (mobile) air cleaners*
*#4 - Verify Ventilation Performance*

In this paper, we will discuss the 3rd component of the Ventilation Strategy - Portable or Mobile Air Cleaners; what they are, key components, and how they work.

**What is a Mobile Air Cleaner?**

Mobile Air Cleaners have a few key components, a fan or blower to pull air through the device, a pre-filter and a final (HEPA) filter. These components are housed in a cabinet with casters to allows the unit to be moved from space-to-space or within a space. The unit also has a plug-and-cord to make powering the unit simple and quick. Here is a schematic of a mobile air cleaner:



Other accessories can be added such as a run-time counter, differential pressure gauge and manual on/off switch to simplify operation and maintenance of components.

**Fan**

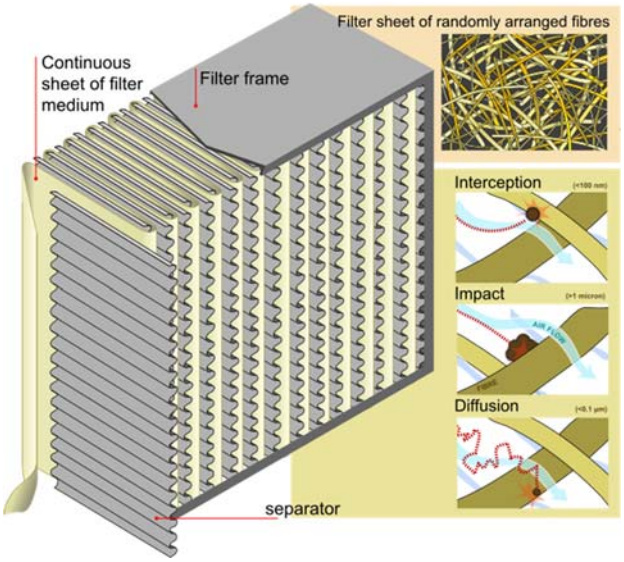
The fan moves the air through the mobile air cleaner. Key considerations for proper unit selection are, the amount of airflow the fan moves to provide adequate filtration, and how quiet the unit is. The Harvard study recommends a minimum of 100 CFM (cubic feet of air per minute) per every 250 square feet of occupied space. A typical classroom of 1000 square feet would require a minimum of 400 cfm. The mobile air cleaner manufacturer will normally provide sizes of units and performances to choose from. It may be useful to select a unit capable of more air movement than the minimum so it can be used in larger spaces as well. In this case, variable speed control is desirable to balance the airflow and sound to meet the needs of the space.

**Pre-filter**

The pre-filter is mounted just after the fan and is there to capture relatively large particles carried aloft in the breathing zone. Pre-filters are designated with a MERV rating. MERV stands for Minimum Efficiency Reporting Value. The MERV rating evaluates the efficiency of a filter based on how well it captures particles of a particular range of sizes. The higher the MERV rating, the better the filter captures particles in that size range. Generally, a minimum of MERV 8 is utilized for the pre-filter. A MERV 8 filter will trap 70 – 85% of particles 3 microns or larger. These particles are generally dust, lint, pollen, mites and mold. The primary purpose of the pre-filter is to prevent these 'large' particles from getting to the final filter.

**Final (HEPA) Filter**

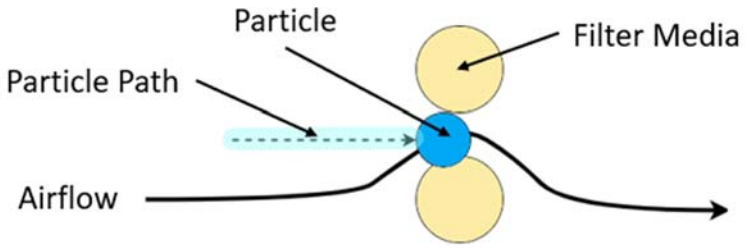
The final filter is intended to capture much smaller particulate. The final filter should have a rating of greater than MERV 16. Filters with a MERV 17 rating are referred to as HEPA filters. HEPA filter stands for 'High Efficiency Particulate Air' filter. HEPA filters capture 99.97% of particles 0.3 microns or larger. HEPA filters do an excellent job of trapping even smaller particles down to 0.01 microns through a process called diffusion. Let's take a look at the ways a HEPA filter traps airborne particulate.



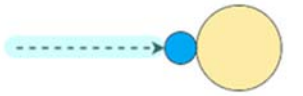
The drawing above shows the basic construction of a HEPA filter. The filter media itself is made up of a sheet of randomly arrayed fibers and is folded many times to increase filter area. As particles travel through the media, they are captured by a combination of various mechanisms.

**Filtering Mechanisms**

The first means of filtration is 'Sieving'. Sieving is best at capturing particles larger than 1 micron. Sieving is essentially the capturing of particles that are larger than the space between fibers.

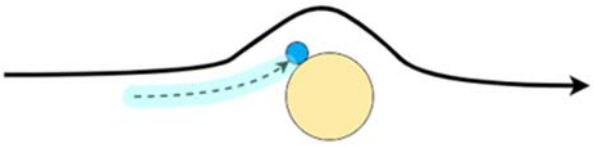



The second method of filtration is 'Impaction'. Impaction involves a particle 'banging' into a filter media fiber and becoming attached to the fiber. This method of filtration works best on particles larger than 0.4 microns in size.



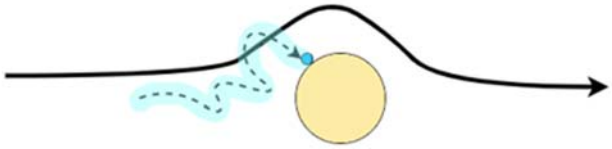
Impaction

The third filtration mechanism is 'Interception'. This works best on particles between 0.1 and 0.4 microns. Interception is essentially the particle brushing up against a fiber and being 'snagged' by it.



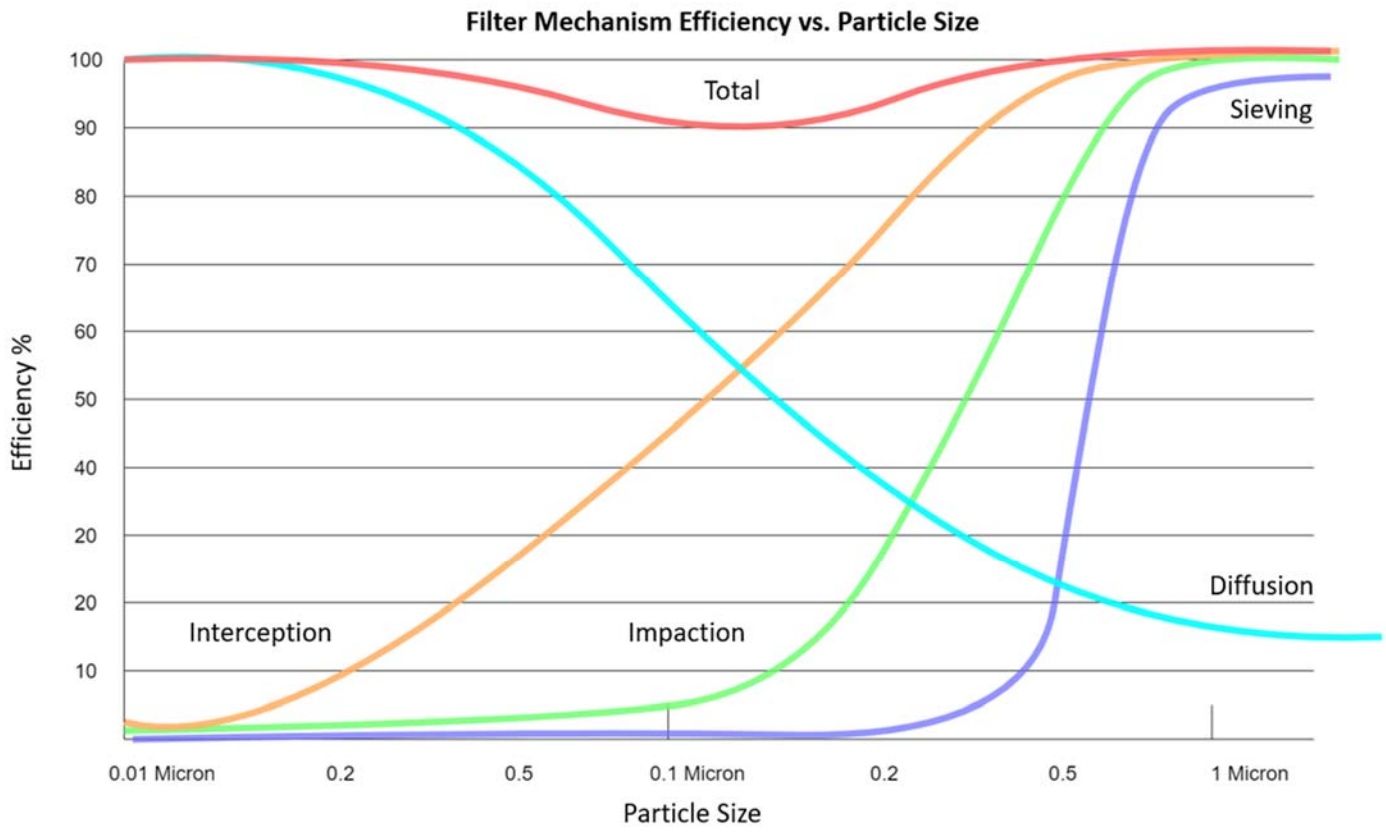
Interception

Finally, the process of 'diffusion' works best at capturing particles from 0.3 microns down to 0.01 microns. This occurs because very small particles tend to travel in erratic path due to a phenomenon call 'Brownian' motion. The motion increases the length of the path and consequently the time the particle has within the filter media, increasing the chances of capture.



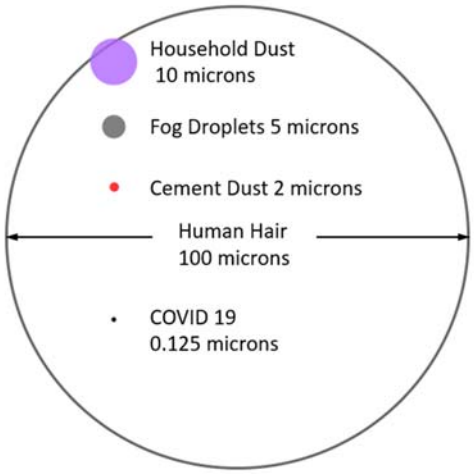
Diffusion

If we look at the overall filtration efficiency vs. particle size, we can see how these methods work together to filter particles over a range of sizes.




**Particle Sizes and Units of Measure**

We have mentioned the term micron several times in this paper. You may not be familiar with the term, so let's take a minute to add some sense of scale.



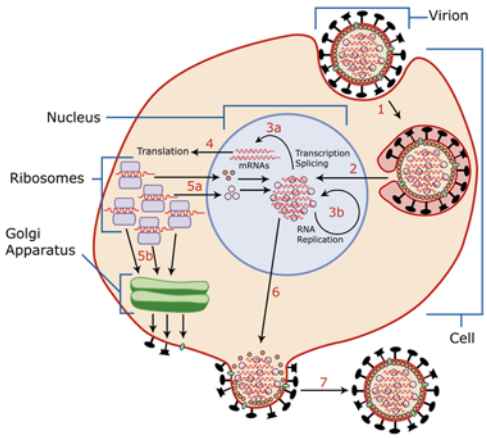

**Relative Particle Size**

A millimeter is 1/1000th of a meter and is about the size of the head of a pin. A micron (also called a micrometer) is 1/1000th of a millimeter and is about the size of a droplet of fog. The COVID 19 virus is about 1/8th of a micron in diameter or 0.125 microns.

Reviewing the information above, we can see that virus particles are extremely small, but well within the range of particles that HEPA filters capture efficiently. Additionally, airborne virus particles that are emitted by a cough or sneeze are generally contained in droplets that are much larger than the virus. HEPA filters capture very close to 100% of these particles. When you recirculate air through the mobile air cleaner repeatedly, fewer and fewer particles are left in the air to breathe.

**Virus Particles**

Virus particles need a living host to 'survive' and multiply. Once they are captured by a HEPA filter, they eventually lose their efficacy and disintegrate. No need to worry about the particles that get captured by the HEPA filter.




**Virus Particles Need Living Cells to Replicate**

**Summary**

As you can see, a Mobile Air Cleaner can be very effective at capturing viruses and other particulate in the air such as mold, pollen, and bacteria, to provide a better and safer breathing environment. Utilizing mobile air cleaners as a part of your ventilation strategy can help you clean the air of particulate that cause infection, disease and allergies, reducing associated risks.

Loren Cook Company has a complete line of Mobile Air Cleaners to choose from to help you mitigate risk of transfer of airborne viruses, bacteria and allergens. Download a MAC Fan flyer from lorencook.com and contact your local Cook rep for more information about the complete line of MAC fans.

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