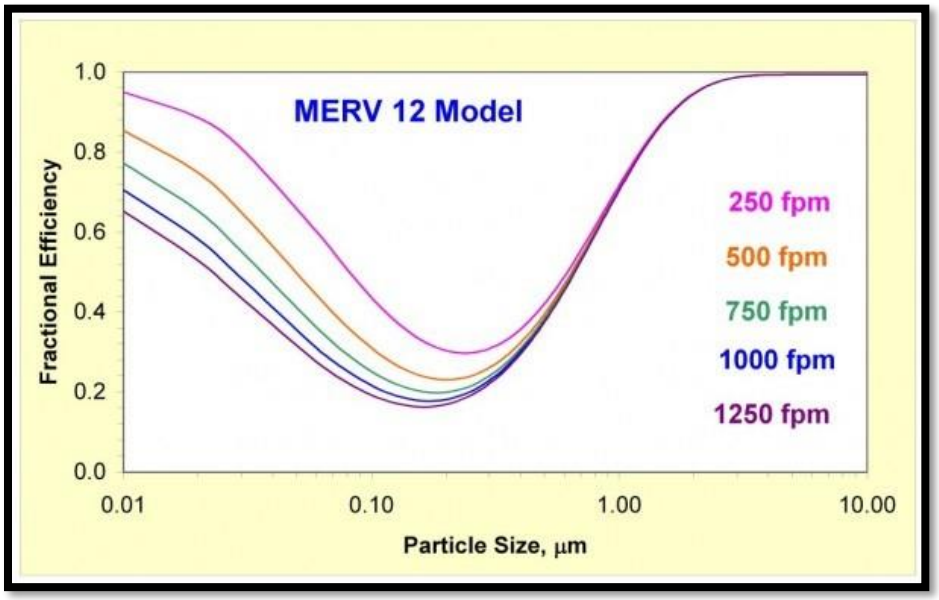
# Improving Filtration Removal of Airborne Pathogens

David N. Schurk, DES., CEM., LEED-AP., CDSM, CWEP., SPP, CIAQM., HCCC.
ASHRAE Distinguished Lecturer, Healthcare-Strategic Account Manager for Carrier West

This model shows estimates of MERV-12 filter performance at various operating velocities in feet-per-minute of airflow through the filter. Higher airflow velocities cause an increase in larger particles to be filtered by inertial impaction and interception while at lower airflows smaller particles have higher Brownian motion, increasing the number of particles that will be captured by diffusion. As a result, a change in airflow rate shifts the filter efficiency curve and alters the Most Penetrating Particle Size (MPPS).




This demonstrates that lowering the airflow through a filter may be better for increasing particle penetration in the virus and bacteria size ranges of less than 0.3 microns. It's evident that capture efficiencies are greatly affected by changes in filter operating velocity. While not specific to any particular manufacture, this model allows some conclusions which can be applied to both new and existing HVAC ventilation and filtration system design:

1. Simply increasing filter face area will lower the air velocity across the filter bank and help to capture smaller particles from the airstream, but this result in HVAC equipment that is larger and more costly.
2. Simply reducing system airflow will lower the velocity across the filter bank and help to capture smaller particles from the airstream, but this may negatively impact comfort control and ventilation effectiveness.
3. Removing the particles of concern from the space and getting them back to the filter is a critical concern. Many particles are so small and light that they may not be significantly influenced by airflow and therefore can remain suspended in the environment indefinitely. This means these particles are not filtered from the airstream by the HVAC system.
4. Providing air ionization to the space, used as a method to agglomerate (combine) particles through electrical attraction therefore increasing their size and weight, has been proven in helping remove small particles from the environment, getting them back to the filter where they can be captured. It can also help the filter be more effective as theses larger particles may be more easily removed from the airstream. Airflow rates and filter counts may be left in-check with no modification required to the operation or size of the HVAC system.
5. Bipolar Air Ionization (BPI) not only helps agglomerate small particles in the space and airstream but also eliminates mold growth in HVAC air-handing systems. It can address a variety of IAQ issues including contaminants brought in from outdoors (allergens, motor vehicle exhaust, gasoline vapors, chemicals, helipad and emergency generator exhaust). BPI assists in the removal of harmful substances by creating cold-plasma that splits water molecules in the air, producing positive and negative ions which surround pathogens, producing a reaction at the molecular level which deprives them of life-sustaining hydrogen and prevents reproduction. Similarly, these ions interact with various VOCs (odors), causing the compound to break-down into one or more of four basic elements of the atmosphere. This technology also has proven effect on viruses, disrupting the DNA or RNA of certain strains leaving them unable to infect a living and susceptible host.
6. Needlepoint Bipolar Air Ionization (NPBI) shows exceptional promise in achieving all of the above mentioned benefits of traditional BPI, but does so without producing any Ozone, even as an unintentional byproduct of

operation. It therefore complies with ASHRAE Standard 62.1-2019 which requires all Air Cleaning Devices to be labeled in accordance with UL2998. This UL standard requires that qualifying zero Ozone emission products must demonstrate they emit less than the maximum ozone concentration limit of 0.005 ppm (5 ppb) which is below quantifiable levels for Ozone testing. This is 10-fold less than permitted under test standard UL 867, which allows concentrations of 0.05 ppm (50 ppb). UL 2998 doesn't guarantee product performance, it only certifies the technology is safe to use in respect to ozone generation.

## Authors Bio:


David Schurk DES., CEM. LEED-AP., CDSM., CWEP., SFP., CIAQM., HCCC., is Strategic Account Manager-Healthcare for Carrier West, and is based out of Denver, CO. He is a Licensed Designer of Engineering Systems and has over 35-years of experience in the design and analysis of heating, ventilating, and air-conditioning systems for a variety of market sectors, with a special focus on healthcare facilities. David has authored various technical articles for a number of industry trade journals and magazines, and is a featured presenter at regional and national industry events. He can be reached at dschurk@carrierwest.com or 920-530-7677.