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SAFE, BREATHABLE AIR

The LTC Long-Term Playbook

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SAFE, BREATHABLE AIR

Introduction

Nearly three years since our lives were disrupted by a pandemic that blind sided us, and we are still contemplating whether or not we should address the air we breathe, or leave well enough alone and ride out the storm. We have let complacency determine our next steps and have faltered along the way through one of the most trying tragedy of our lifetime. We were given contradicting, confusing guidance from CDC and received government funds that have been distributed without accountability. In spite of all the legislative action, time, and money spent on COVID relief we have yet to established viable, ratified standards on how to implement proper mitigation strategies to reduce our level of bio-aerosol exposure and general poor IAQ.

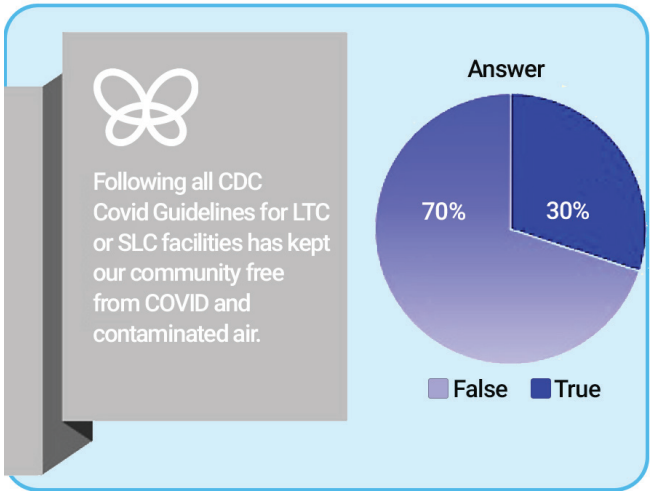
Compounding the lack of guidance and necessary but missing accountability is the false assumption that the COVID-19 vaccine was going to be the cure-all and eradicate the virus all together. As we have seen, this is not the case, and in fact, provided a false sense of security and was a driving factor as to why the very air we breathe continues to be the forgotten path to reducing future pandemic shutdowns, mass mortalities, and the overloading of our healthcare system.

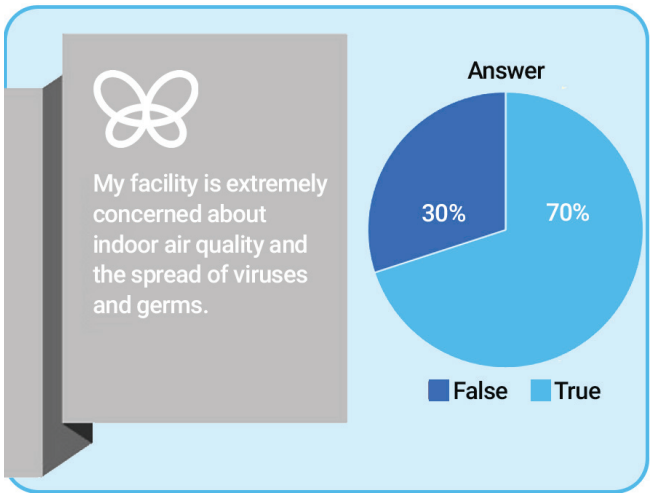
As I write this, we are beginning to get a glimpse of a path back to 'normalcy', but without a true path forward that recognizes the mistakes made, we base this new normal on a very fragile society unprepared for the next pandemic. Planning for future pandemics and ever increasing poor air quality should be the number one priority of our long-term care community executives and stakeholders. The LTC and senior living communities have experienced facility shut downs, staffing issues, and an overall increase in home care at levels unimaginable. Without a revised, informed path forward to make facilities safer, the future is concerning to say the least.

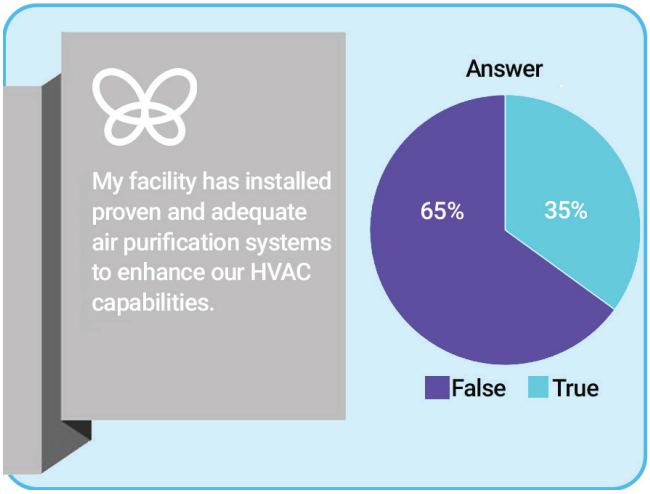
To reiterate, this is not just a COVID 19 issue but stems from many years of facility neglect, which brings us to the overall importance of Indoor Air Quality (IAQ) and how it impacts your health, your staff and your resident's health.

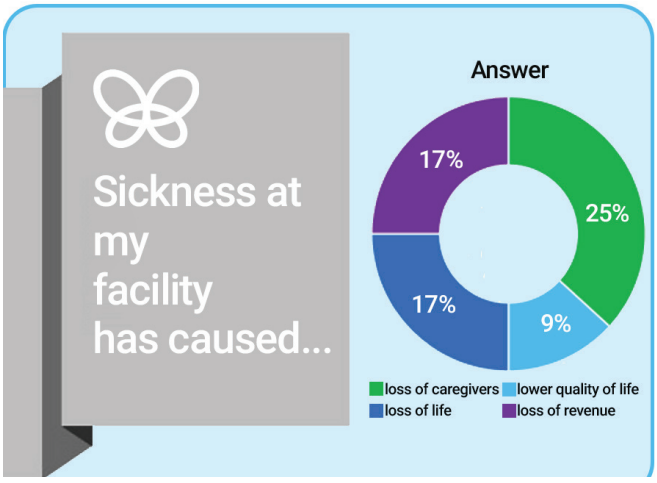
Challenges as they exist today

Due to the risks associated with bio-aerosols the LTC and Senior Living communities have seen tremendous heartache from loss of life, loss of care givers, and facility shutdowns to name a few. But there are other underlying issues to be concerned with that might take a back seat to the aforementioned, such as; psycho-social effects of isolation, cost of isolation, and lets not forget what I believe to be one of the most important factors, the inability to see loved ones and offer comfort and support. So, how can we reduce risks and improve the quality of life, while also creating an atmosphere were people can feel safe working, while caring for the most vulnerable. To truly understand the LTC challenges it is best to hear from those who have suffered during the pandemic. A recent LTC survey, sent to people currently working as staff and directors, was conducted to try and pinpoint how the pandemic affected their communities and colleagues.







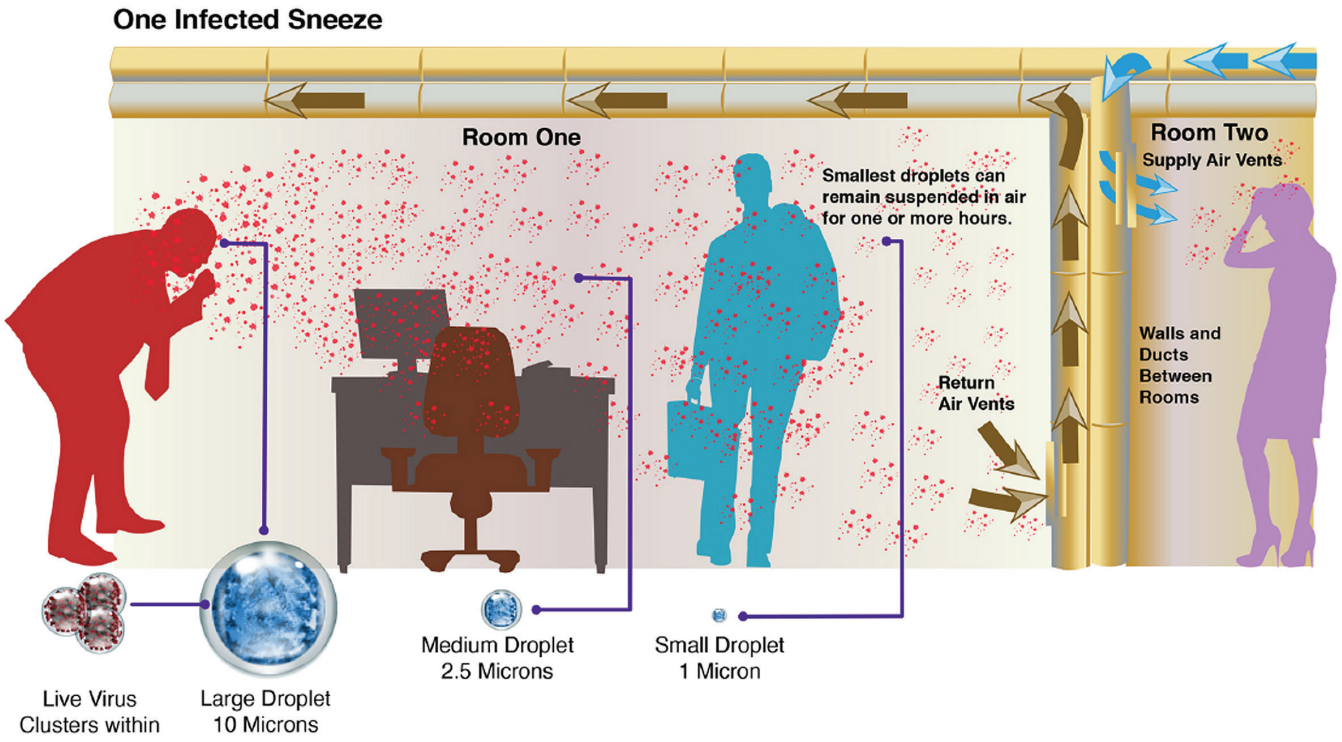


It's clear that Indoor air quality has not been properly addressed, but what can be done and how? After all, most of the guidance received from CDC and ASHRAE has been unattainable for many reasons, and some of the guidance has even been inadequate.

Let's proceed by taking a step back to truly get a sense of why IAQ is so important and why we can't use inadequate government guidance as our primary baseline for improving our facilities overall safety.

Aerosolized Virus Transmission

There are many ways that a virus is transmitted, but airborne aerosolized droplets are the primary form of spread. When these micro-sized droplets are released, they remain suspended in the air for several hours (or longer). To add to the risk of exposure from these pollutants they are likely to travel through the building HVAC system if not appropriately designed to allow for them passing through MERV rated filters.



PANDEMIC IMPACT ON THE LTC COMMUNITY

As of December 2021, there were more than 220,000 fewer filled positions.

Working conditions and pay were creating shortages before the pandemic

AARP poll found that 77% of adults 50 and older prefer to remain in their homes for the long terms and has been increasing since the pandemic

AARP stats show that more than $50 billion to Medicaid and $25 billion to Medicare with no accountability of how the monies were spent

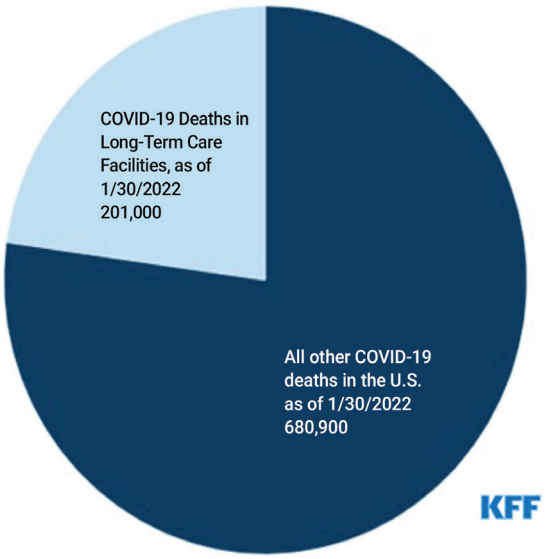


Figure 1. Long-Term Care Facility Residents and Staff account for more than 201,000 COVID-19 deaths, and at least 23% of ALL COVID-19 deaths in the U.S. as of January 30, 2022.

SOURCE: Long-term care death count is from KFF analytics of CMS COVID-19 Nursing Home Data, available state reports press releases, and official state data through news reports. Total COVID-19 death count is from CDC. All data sources are as of January 30th, 2022 - PNG

NOTE: LTCF death count is an undercount since this count excludes deaths in non-nursing home LTCF settings after June 30th, 2021 and also reflects some incomplete state reporting prior to the that date. Some of the "All other COVID-19 deaths in the U.S." count likely reflect LTCF deaths that have not been categorized as such.

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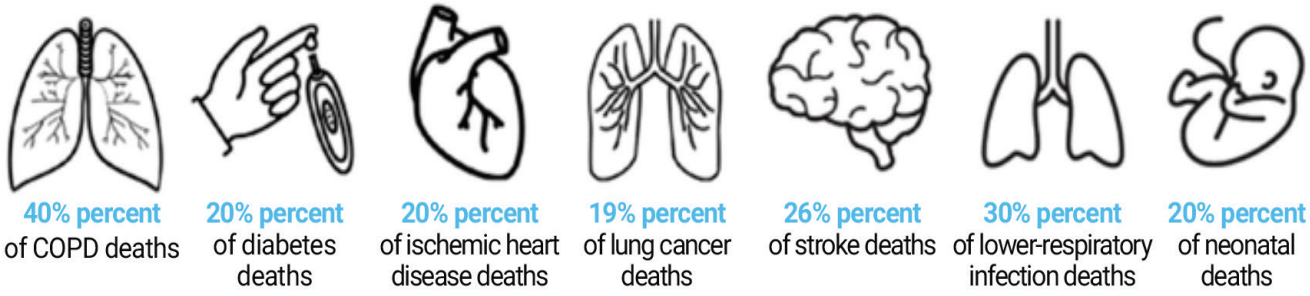
Everyday Indoor Air Dangers

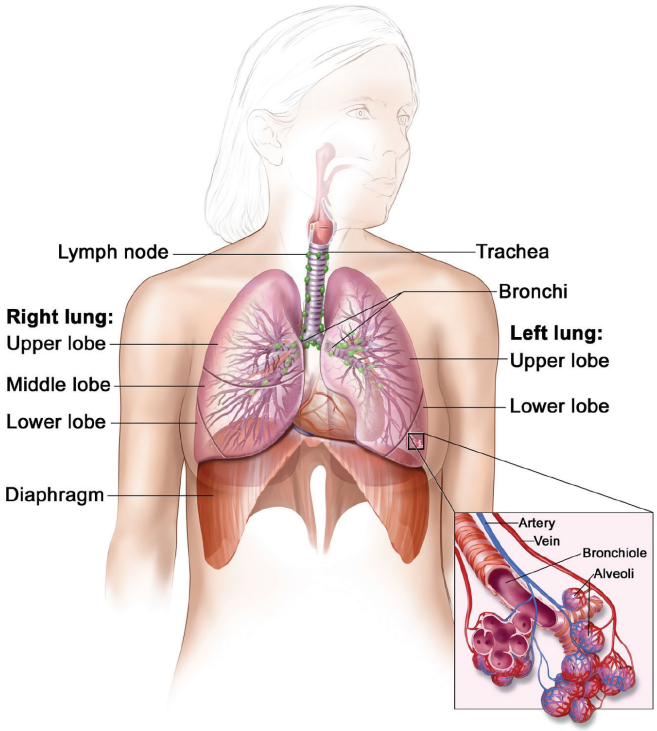
While a great deal of our attention has been on the risk of aerosolized viral transmission, it should not be our only concern. Every day, we are exposed to hidden dangers that impact our health. These hidden dangers are what is known as PM 2.5 (particulate matter at 2.5 microns or less in diameter) and consist of molds, bacterium, fungi, and viruses. In fact, the exposure to these pollutants contribute to over 7 million premature deaths worldwide every year. And the EPA ranks IAQ as one of the top 5 environmental health dangers. Okay, but how does this really affect me? Well, let's look at the chart below to truly understand the health impacts of poor indoor air quality:



Why such a health impact? It is because these tiny droplets wreak havoc on our bodies—particularly our respiratory systems—as they are inhaled deep into our lungs. Our bodies are incapable of filtering these tiny particles out, leading to lower respiratory tract infection and increasing the severity of disease.

Studies have linked particle pollution exposure to a variety of respiratory health effects, including:

- Respiratory symptoms including cough, phlegm, and wheezing.
- Acute, reversible decrement in pulmonary function.
- Inflammation of the airways and lung (this is acute and neutrophilic).
- Bronchial hyperreactivity.
- Acute phase reaction.
- Respiratory infections.
- Respiratory emergency department visits.
- Respiratory hospitalizations.
- Decreased lung function growth in children.
- Chronic loss of pulmonary function in adults.
- Asthma development.
- Premature mortality in people with chronic lung disease.



People with heart or lung disease, older adults, children, people with diabetes, and people of lower SES are at greater risk of particulate pollution-related health effects. Though the respiratory system has remarkable resilience to air pollution via its repeated mobilization of defense and repair mechanisms, constant exposure to elevated particle pollution will contribute to reduced respiratory function, even in apparently healthy people. Therefore, although we cannot completely avoid particulate pollution exposure, taking simple steps to reduce exposure will reduce the severity of lung and systemic adverse health effects in both healthy and more sensitive people.

(Source: https://www.epa.gov/particle-pollution-and-your-patients-health/health-effects-pm-patients-lung-disease)

Proposing Solutions That Work With Real-World Efficacy.

As we all discuss mitigation strategies, many are looking for guidance to determine the cost implications of mitigating risk.

The American Society of Refrigeration and Air- Conditioning's (ASHRAE) positioning document on infectious aerosols states that the design and operation of HVAC systems can influence infectious aerosol transport, but they are only one part of infection control. Their positioning document on Indoor Air Quality (IAQ) and the CDC's recommendation for ventilation in buildings outline the criteria that buildings should follow to improve IAQ and decrease the risk of viral transmission.

However, with upgrades, there are always challenges to consider. These include the impact integration could have on the building's ventilation and, of course, costs.

They provide several key recommendations:

- Increase air change rates (ACH) and minimum outdoor airflow rates
- Ensure proper air distribution, or dirty to clean directional airflow patterns
- Increase air filtration within the ventilation without reducing design airflow, or decreasing the air change rates.
- Add HEPA filtered systems to enhance air cleaning
- Use upper room UVGI as a supplement to aid in the mitigation of SARS-CoV-2

Ventilation System Upgrades: High-Efficiency Filters

Let's start with the option to upgrade to high-efficiency filters. How effective are they and how can they impact the ventilation system?
The use of high-efficiency particle filters (HEPA) or Minimum Efficiency Reporting Value (MERV) when installed within the Air Handling Units (AHUs) can reduce airborne pollution and viral loads. Particles leave a room, enter the return vent, and go through the ductwork, where they eventually make it to the filters installed in the air handling units. The air is then scrubbed before returning back to the supply vents. These AHUs also scrub outdoor air before it enters the supply vents (see diagram 1).

While in principle this looks like an effective way to treat the air within your facility, looks can be deceiving. There are many obstacles we need to be aware of.

In order to remove at least 85% of particles, viruses, and bacteria from the airstream, you must use a filter that is at least rated MERV 13. This rating demands a certain level of performance when it comes to capturing tiny particles. They must capture:

- 90% of particles between 3-10 microns
- 85% of particles between 1-3 microns
- 50% of particles between 0.125-2.5 microns

Here's the problem: when virus particles are aerosolized—when we speak, sing, cough, breath, or sneeze—they can float in the air at a size between 0.125 and 5 microns.
Based on MERV 13 efficiency ratings, these dangerous particles are captured at an efficiency of only 50%. With this degree of filtration, a facility will not be able to effectively mitigate risk of transmission.

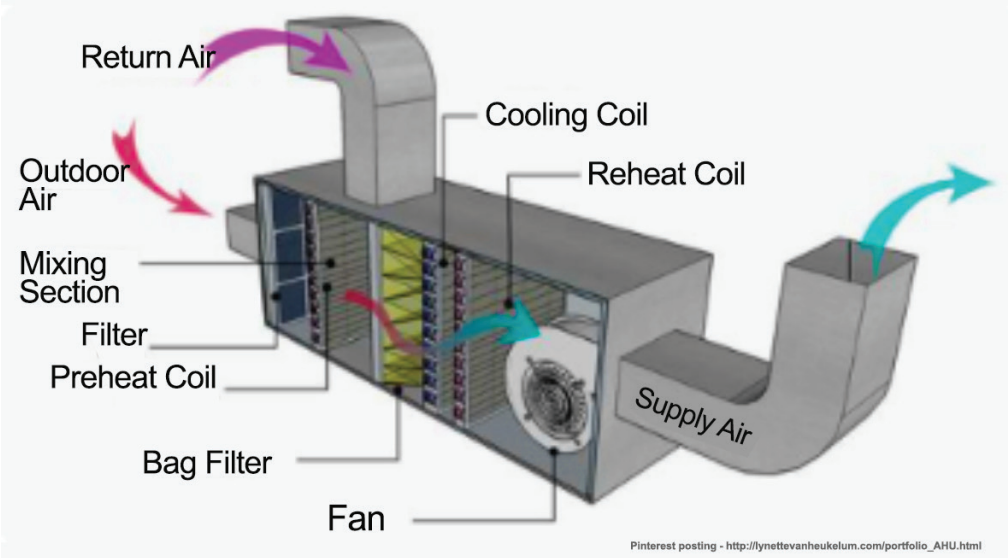


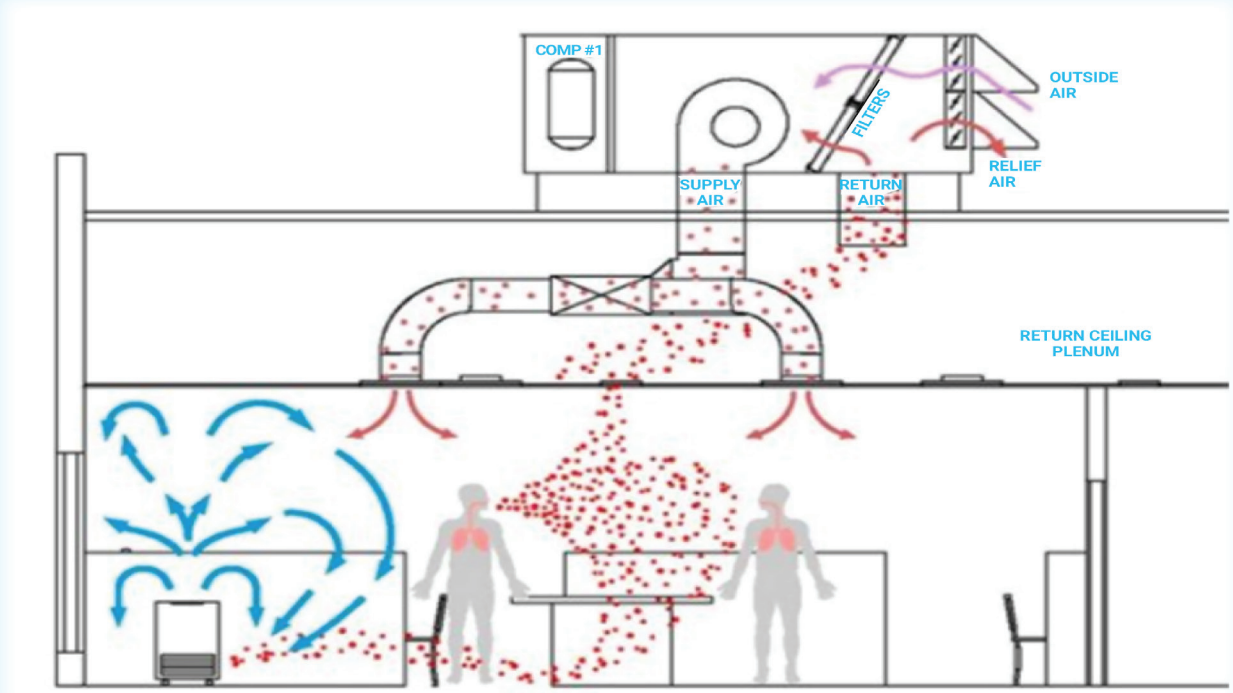
Diagram 1: Air Handling Units

Additionally, these filters sacrifice comfort; when adding a MERV 13 filter you are adding air flow resistance and in turn a larger pressure drop across the filter. Too much pressure will add strain on the blower's motor and reduce air flow, ultimately reducing comfort and compromising your heating and cooling system. These changes could also impact the buildings humidity control which can have a major impact on how viruses and bacteria travel around the building. The relative humidity in the building should remain between 40% and 60%. Because of these challenges, most facilities don't have the ability to add MERV 13 filters, let alone more advanced HEPA filters.

MERV Rating	Air Filter will trap Air Particles size .3 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 & Aluminium 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 ~ Mold Spores, Cooking Dusts, Hair Spray, Furniture Polish
MERV 6	<20%	<20%	35% - 49%	
MERV 7	<20%	<20%	50% - 69%	
MERV 8	<20%	<20%	70% - 85%	
MERV 9	<20%	Less than 50%	85% or Better	Better Home Box Filter ~ Lead Dust, Flour, Auto Fumes, Welding Fumes
MERV 10	<20%	50% - 64%	85% or Better	
MERV 11	<20%	65% - 79%	85% or Better	
MERV 12	<20%	80% - 90%	90% or Better	
MERV 13	Less than 75%	90% or Better	90% or Better	Superior Commercial Filters ~ Bacteria, Smoke, Sneezes
MERV 14	75% = 84%	90% or Better	90% or Better	
MERV 15	85% = 94%	95% or Better	90% or Better	
MERV 16	95% or Better	95% or Better	90% or Better	

The Unpredictability of HVAC Systems and Inadequate Filtration Systems

With the current guidance, or lack there of, we are really setting ourselves up for mitigation strategies that will be deficient at best. For instance lets say you increases your HVAC filters and added a floor mounted HEPA filtration system, one would think they have done everything to reduce risks, right?



Unfortunately its not that easy. With the above mentioned challenges, we also have to look at the unpredictability of air flow. First, with any HVAC system eradication of pollutants is only going to occur when the system is on allowing for concentration loads to accumulate while the air is static. But isn't that why we have portable HEPA filtration systems? In theory yes, but most are not designed to handle high concentration and are positioned in very undesirable location capturing minimal contaminates of the micron size we are mostly concerned about as seen in the above diagram. While air in one area is processed continuously, the breathing zone is never purified. Air flow distribution, total air flow, proper sizing and placement of any HEPA filtered device needs to be considered. Every facility is designed differently and a tailored approach on how to implement technologies must be taken.

The Financial Impact Of HVAC

The financial impact cannot go unnoted, but can be reduced by researching the technologies available. While we mentioned the cost impact of ventilation on an annual scale, we have not addressed the upfront cost of upgrades. This cost varies greatly depending on the facility's size, current layout, and available AHUs to process the additional cubic feet per minute (CFM) of air required. This makes it difficult to provide a standardized cost estimate, but the impact could be significant based on these factors:

- Are your AHUs sized appropriately to add additional CFM requirements?
- By adding more CFM, will your heating and cooling loads be impacted? If so, you may also need to upgrade your heating and cooling sources.
- How will you maintain relative humidity to be within 40%-60%?

Proposing a Solution That Works with Real-World Efficacy

The ceiling-mounted HALO filtration system was originally designed to protect laboratory personnel from laboratory pollution exposure.

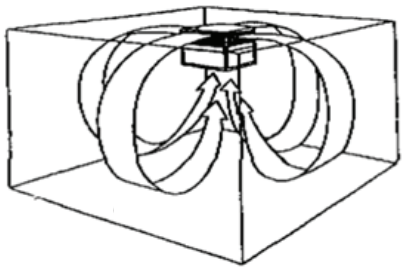
The design was based on a very delicate equation of the right airflow, depth of carbon bed, and air distribution.

This unique approach was developed through over 50 years' experience in providing air filtering solutions to laboratories across the globe. Our flexible and adaptable designs give us the ability to integrate HEPA H14 or ULPA U17 filters to the Halo. This has allowed us to adapt to the necessary demands of HEPA-filtered air purifiers, even outside of the laboratory. Because of the strict standards we have had to adhere to within the lab world, the Halo was designed with more than just filtration in mind. It also takes into consideration the impact the Halo would have on the facility's ventilation effectiveness (VEFF) and increases in air change rate (ACH).

The Halo's proven efficiency in a lab setting is transferable to the commercial world and has provided us the ability to ensure we meet all necessary criteria, such as:

- Air flow pattern distribution
- Increased ACH
- Optimal H14 HEPA filtration

Each Halo will provide 3 additional ACH per every 3,500 Cu' of volume. The placement of the Halo is critical to achieving such phenomenal results. Its position on the ceiling creates a vertical air flow pattern that drives polluted air up and away from the breathing zone and returns clean air back into the very same room horizontally across the ceiling. This creates what is known as the Coanda effect:



Coanda Air Flow

Data derived from a number of different third-party tests proves Halo's performance against aerosolized viruses and PM 2.5. Tests were conducted in both controlled spaces and in real-world conditions to truly understand the efficacy of the Halo's performance.

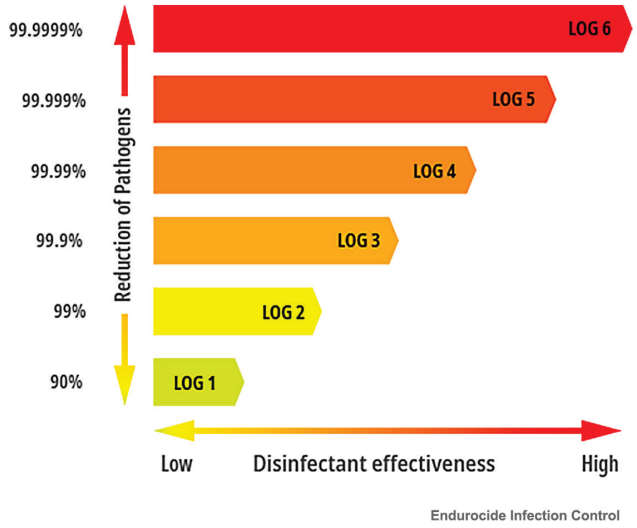
With other virus mitigation options, there are serious risks to consider. Simply put, there is a lot of snake oil available on the market. Everywhere you look, someone seems to have the best possible solution. They promise 99.99% decontamination or effectiveness. The reality is there are many unethical companies that are taking advantage of the current anxiety-ridden air purification market. At Erlab, our data is unmatched, third-party certified, and not full of "fluff" data. We provide the truth and set the expectations according to the product's actual performance in a real-world setting. There is simply no false data or misleading performance criteria. The Halo will perform as advertised and will mitigate the risk of airborne spread, while also improving your IAQ. This is a long-term solution; the Halo is a permanent infrastructure improvement without the infrastructure cost or complexities.

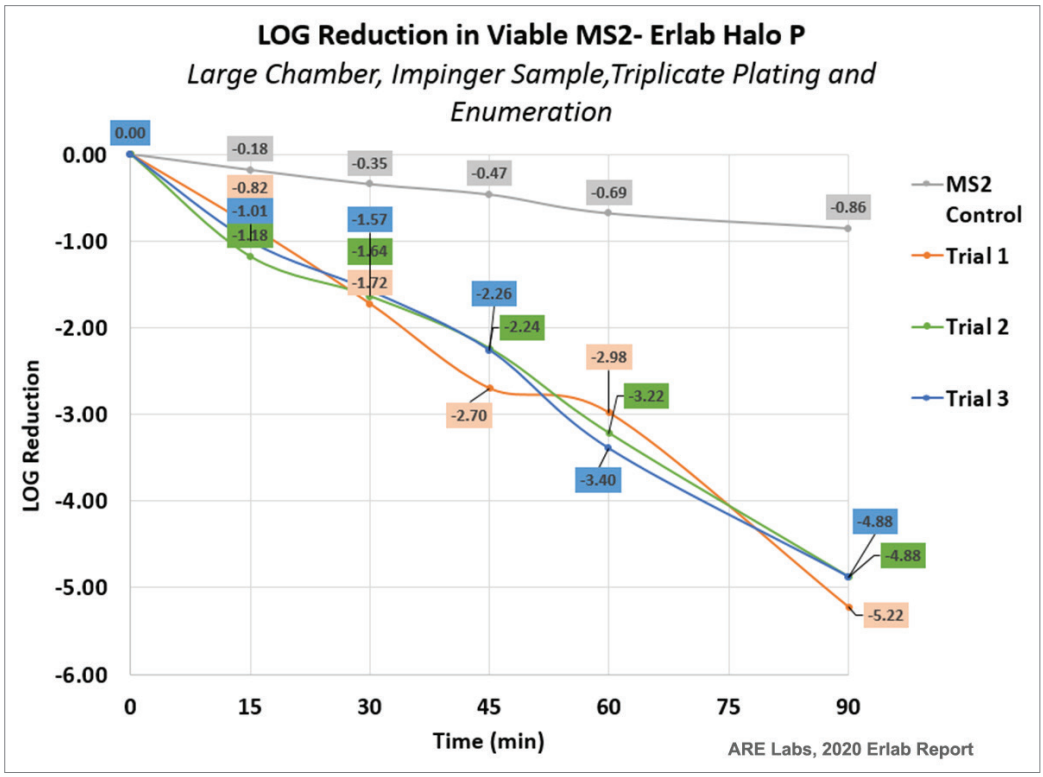
This is a solution for today's challenges and tomorrow's well-being.

Halo Smart Air Purification Stations

Efficacy of the Halo HEPA system against aerosolized viruses:

The Halo was tested within a controlled Biosafety Level chamber under challenge conditions where MS2 bacteriophage was purged into the chamber and held for 90 minutes in order to obtain total log reduction results over time. As seen in the below graph, log reductions were achieved within 15 minutes, with a continuous decrease throughout the 90 minute challenge test, which equates to a 99.99% reduction in viable MS2.





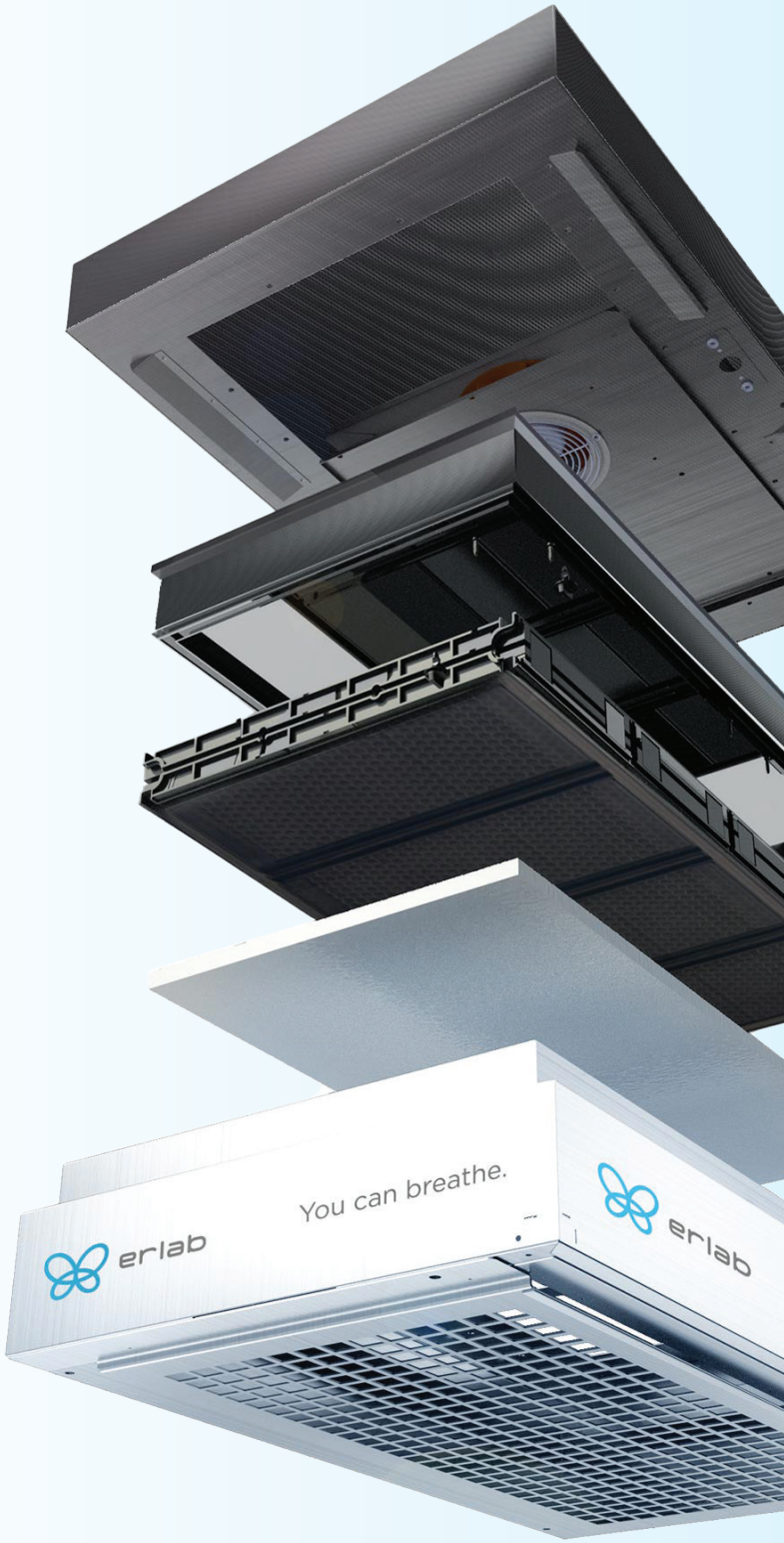
The Long-Term Playbook

What should a business do in order to improve air quality and minimize the risk of viral transmission? It starts with understanding your current ventilation. You should seek to answer these key questions:

- What will it cost to increase my air change rates per hour, what impact will this have on my current heating and cooling loads?
- Can my system, as currently designed, handle an upgrade in filters?
- If we increase our air change rates and upgrade our filters, how are we going to control possible re-entrainment concerns?

In most cases, there should be a supplemental solution to tie in with your existing ventilation system. The most effective supplemental technology would be air filtration with HEPA rated filters, positioned above the breathing zone (ceiling mounted) to ensure proper airflow patterns, and increased ventilation effectiveness with proper room mixing. The size of each room will need to be taken into consideration as it will determine the effectiveness of air purifiers.

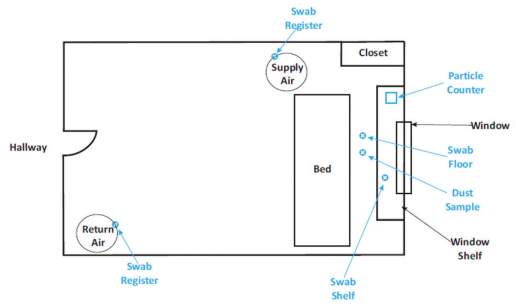
Whichever direction you decide is best for your facility's unique situation, the decision should be a permanent one backed by data.



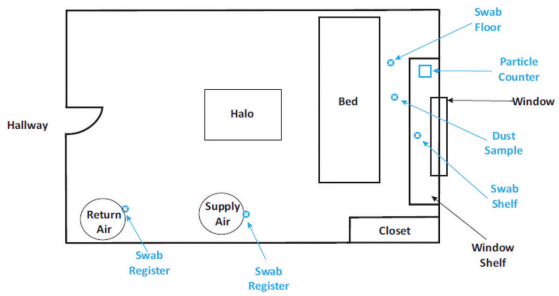
Real-world performance results:

In order to further validate the Halo's efficiency at mitigating the risk of airborne viral transmission, we tested the Halo within an isolation room of a confirmed COVID 19 positive patient against an adjacent isolation room of a confirmed COVID 19 patient of which both shared the same air handling system. Each room was swabbed at the floor, window surface and at the return registers for SARS-CoV-2 using the gold standard of a polymerase chain reaction (PCR) test. The results as (seen below) provide us with some key pieces of information, such as; Viral shedding of each patient and reduction of present SRA-CoV-2 RNA. Based on these results it is clear the patient in room 120 (with the Halo) had significant viral shedding as they were at the beginning of isolation, whereas the patient in room 118 (without HALO) viral shedding was minimal as they were at the end of isolation. However, even with the significant amount of shedding from the patient in room 120, there was still no detectable RNA found at the return register, or within the airstream further solidifying the performance of the Halo at mitigating airborne viral loads and concentrations. Antithetical to these results are the results in room 118, where SARS-CoV-02 RNA was present at the return register and within the airstream even without detectable RNA present anywhere else within the room.

Room 118 Schematic



Room 120 Schematic



Covid Surface Sample Results

Location in Room	N1, N2 proteins	Result	# RNA copies
118 supply register	ND	ND	--
118 return register	Positive	Positive	3,500
118 floor by bed	ND	ND	--
118 window shelf	ND	ND	--
120 supply register	ND	ND	--
120 return register	ND	ND	--
120 floor by bed	Positive	Positive	23,000
120 window shelf	Positive	Positive	820

Both rooms had covid positive patients, Room 120 had Halo unit, ND = non-detect

Contact us for more information or report details

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Conclusion

As we deal with a viral pandemic, we also have to be sure to address the unfortunate reality of poor air quality. We can take immediate positive action concerning the air we breathe indoors with the proper technologies and mitigation strategies in place.

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You can breathe.

As experts in laboratory air filtration and purification since 1968, our products offer the highest level of protection to laboratory personnel and the general public. Throughout our rich 50 year history, we have delivered solutions across 40 countries, protecting the air we breathe from within confined spaces while reducing harmful pollutants from being released back out to the environment all while enhancing environmental sustainability. All of our products have been individually tested and certified by industry experts ensuring we meet our customers expectations, delivering the highest of quality products focused on their protection.

Contact Us to Learn More

Jesse Coiro, Director of Growth & Strategic Initiatives, Erlab, Inc.

Email: **jcoiro@erlab.com**

Office : **(800) 964-4434**

Web: **halo.erlab.com**