

veriDART®

Safe Air. Safe Spaces. Safe People.



Optimizing Indoor Air Quality for Health and Safety

Track, Measure, and Verify HVAC Systems Performance



Now more than ever, optimizing indoor air quality for health and safety is top of mind for workplaces, schools, healthcare facilities, and other shared indoor spaces.

Polls indicate that nearly 90% of employees have concerns about workplace safety, particularly in the context of airborne diseases, such as the flu or COVID. According to the National Institute of Occupational Safety and Health, inadequate ventilation is responsible for 52% of indoor air quality risk, including exposure to infectious aerosols.

To keep spaces healthy and safe, cost effectively, it's critical to manage and verify the performance of HVAC systems. **With veriDART® by SafeTraces, customers worldwide ensure healthy, profitable, and sustainable indoor spaces.**



The veriDART® Performance Management Platform

Verifying Cost Efficient Indoor Air Quality

Grounded in peer-reviewed science, veriDART is the first diagnostic platform for verifying real world ventilation and filtration performance for the removal of airborne pathogens. The solution leverages patented aerosol tracing technology with aerosol tracers that safely simulate pathogen mobility and exposure in order to:

- Verify performance and management of HVAC systems
- Provide actionable diagnostic data to optimize HVAC-related safety, sustainability, and savings
- Earn the first-ever UL Verification Mark for aerosol removal in the built environment, powered by SafeTraces

How it Works



1 Regular Performance Checks

Use the veriDART Portal to plan, execute, and manage ventilation and filtration with regular performance checks leveraging Dilution, Survey, and Recirculation Tests.

2 Field Verification of Ventilation and Filtration in High Density Areas

Certified service providers release aerosol tracers to measure and verify how aerosols spread and how quickly they are removed from the air.

3 Results at Your Fingertips with the veriDART Portal

Benchmark, manage, and optimize HVAC system performance of individual buildings and across real estate and facility portfolios. Then, view and download your results to improve systems performance.

4 UL Verified Ventilation & Filtration, powered by SafeTraces

The world's first assessment and rating program to earn an annual UL Verification Mark combines a comprehensive desktop review by the global safety science leader with field verification using veriDART.



veriDART® Applications

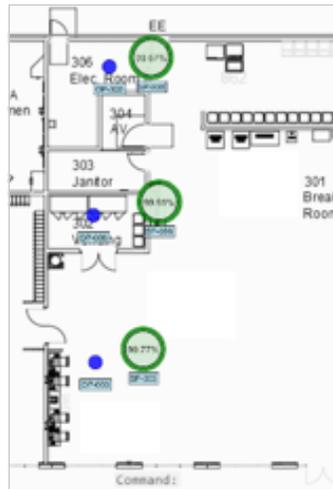
Survey Test ZONE-FOCUSED

Identifies aerosol mobility and hotspots through comprehensive sampling in $\leq 25,000$ square foot zones



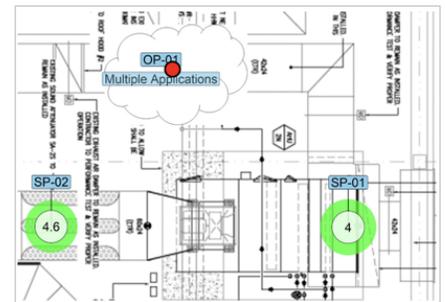
Dilution Test ROOM-FOCUSED

Optimize HVAC settings through scenario testing to clear high density areas of aerosols



Recirculation Test HVAC-FOCUSED

Verifies aerosol mobility to air handling units for improved outside air and filter management



Real World Verification, Real World Value

veriDART delivers actionable data to strengthen health, safety, and sustainability

- Reduce aerosol exposures and infection risk
- Enhance indoor environmental quality (IEQ) programs and compliance
- Optimize capital investments and operating budgets
- Maintain occupancy and leasing levels
- Meet environmental, social, corporate governance (ESG), net zero, and decarbonization goals
- Leverage performance testing for LEED, WELL, and other verification programs



Contact SafeTraces to Subscribe Today

Email us at sales@safetraces.com or visit www.safetraces.com to learn more about how your business or clients could benefit from using veriDART.



veriDART[®] Insights Return on Investment



Return on Investment

Optimizing HVAC Safety, Spend & Sustainability



Health & Safety ROI

- Reduce infectious aerosol exposure and transmission risk
- Increase public trust, confidence and peace of mind in safety
- Meet evolving regulatory compliance and code requirements



Financial ROI

- Reduce absenteeism, shutdowns, and adverse impact to productivity
- Increase and maintain occupancy to pre-COVID levels
- Optimize spend on ventilation and filtration, and commission changes



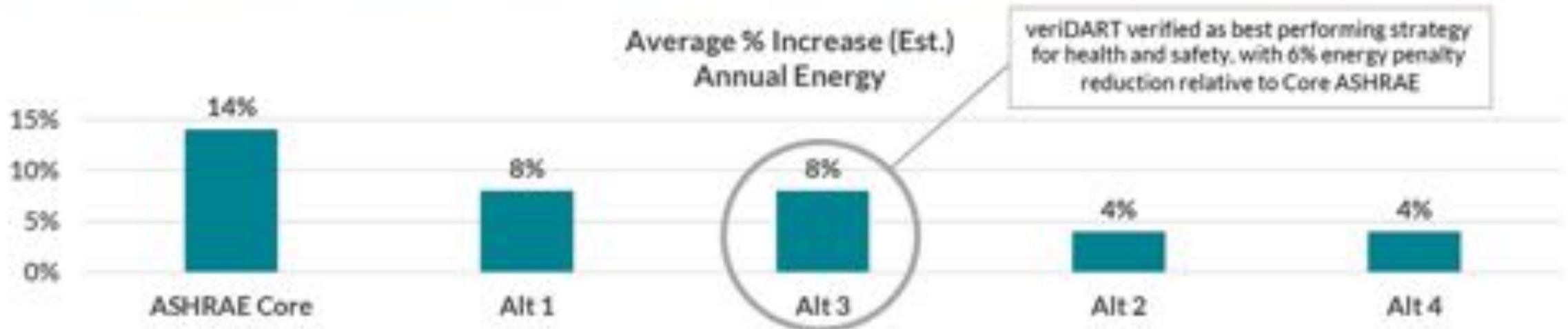
Sustainability ROI

- Reduce energy and carbon penalties from ventilation and filtration
- Meet ESG reporting, net zero, and decarbonization goals
- Apply testing to UL VHB, WELL HSR, LEED, and other verification programs

ROI #1

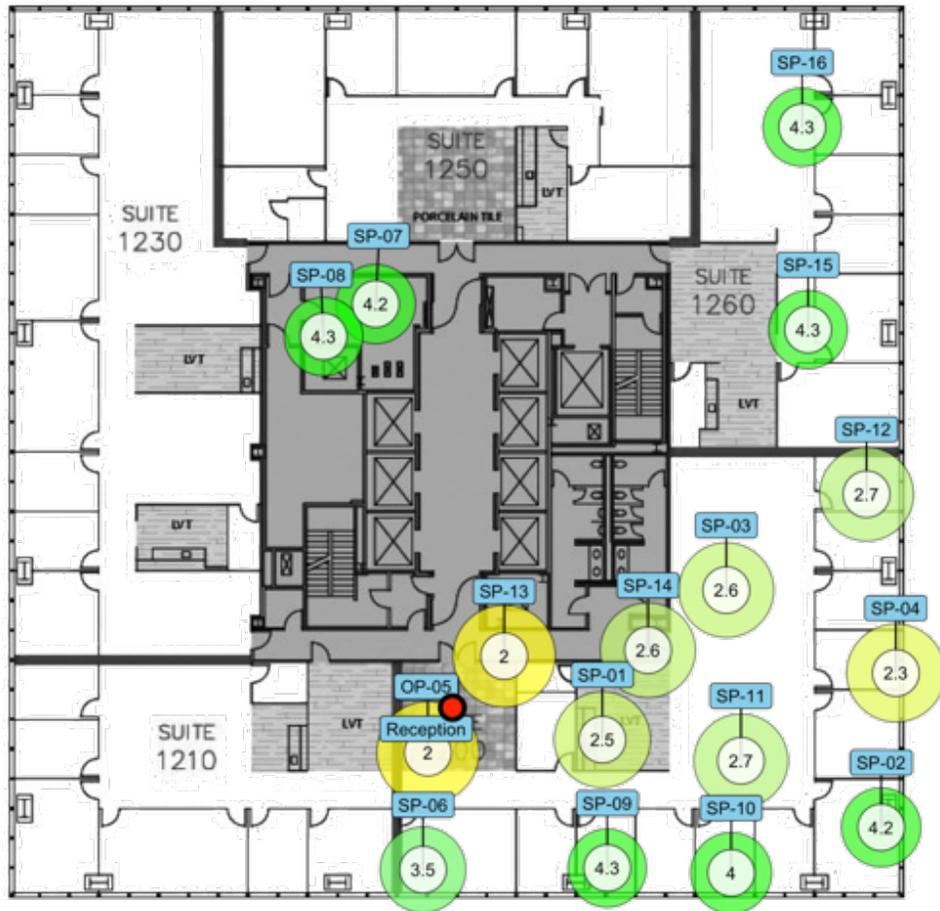
Minimizing Energy (Cost/Carbon) Penalties

Strategy	Core ASHRAE	Alt 1	Alt 2	Alt 3	Alt 4
Filtration	MERV 13	MERV 16	MERV 13	MERV 13	MERV 15/16
Average OA%	Max OA%	Design OA%	Design OA%	Design OA%	Practical OA%
Flushing	2 hr pre/post occ	3 ACH	3 ACH	3 ACH	3 ACH
UV	-	-	In unit	-	-
Portable Filtration	-	-	-	3-6 Additional ACH	-
DCV	Disable	Disable	Disable	Disable	Disable
ERV	Disable	Disable	Disable	Disable	Disable

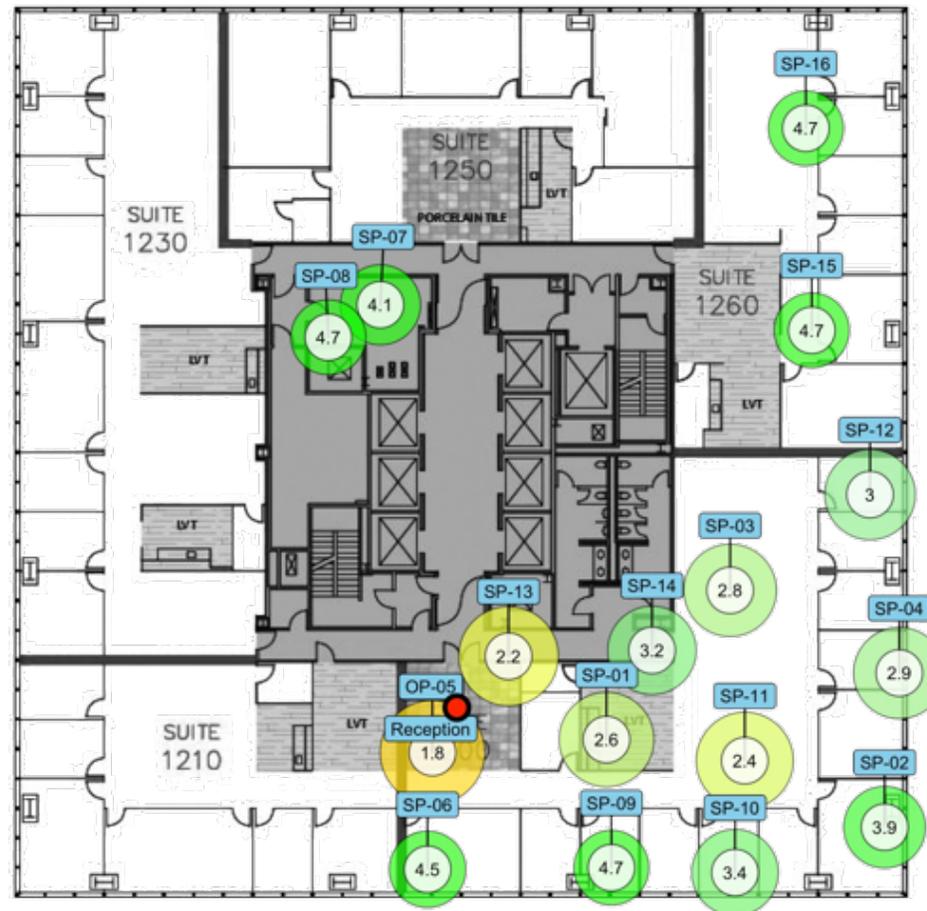


Health & Safety ROI

veriDART Insights: Impact of Outside Air Can Be Negligible

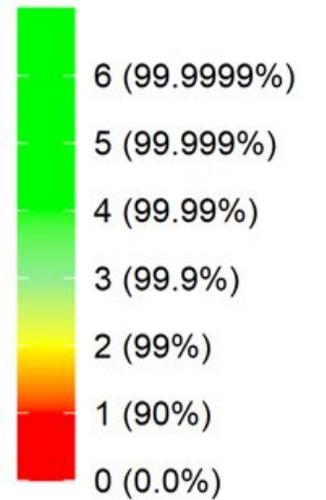


10% OSA
Min Fan Setting



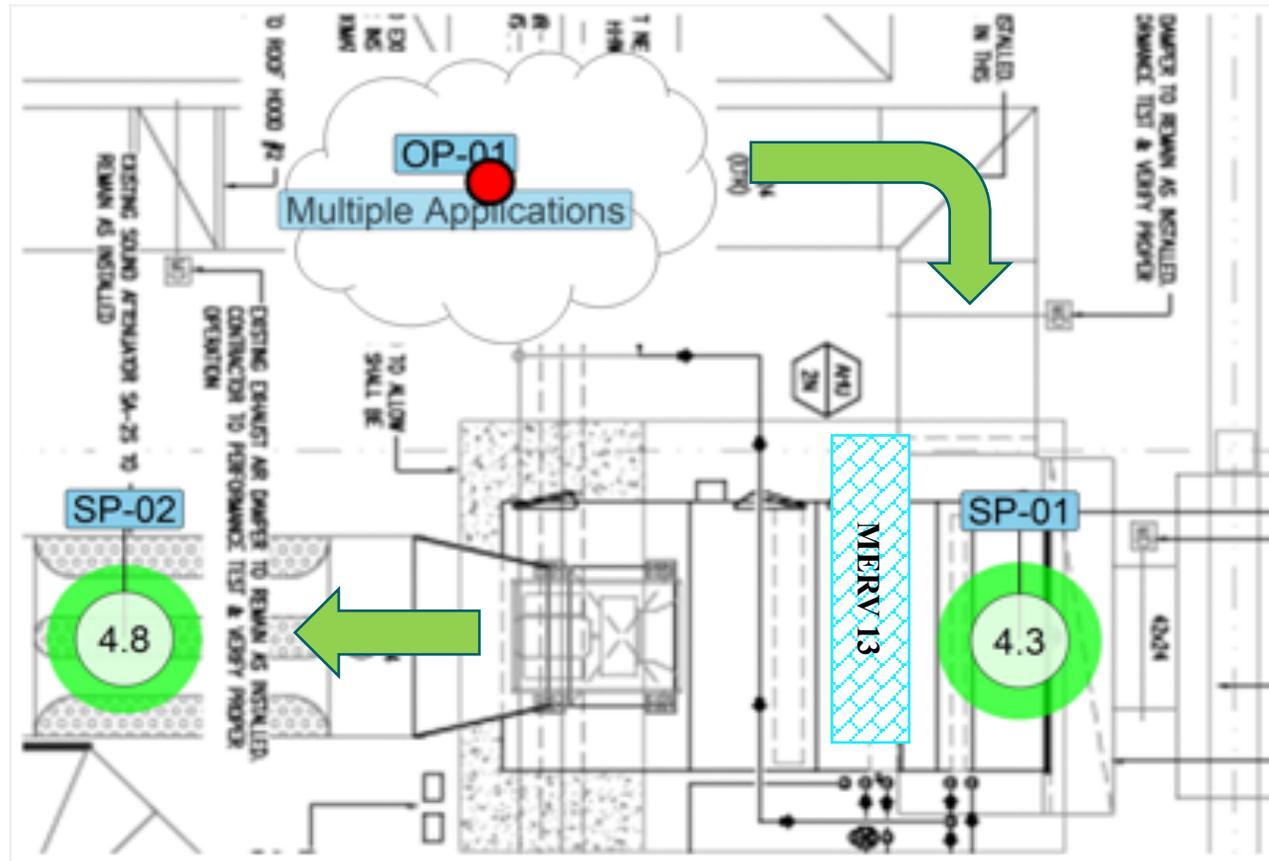
50% OSA
Max Fan Setting

Indicator Tag
Reduction Log₁₀

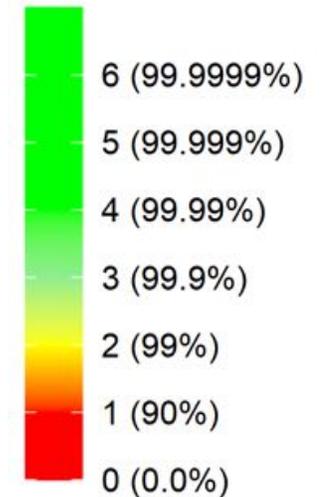


Health & Safety ROI

veriDART Insights: Impact of Central AHU Filters Can Be Negligible



Indicator Tag
Reduction Log₁₀



Health & Safety ROI

veriDART Insights:
HEPA's Are Impactful When Properly Sized and Positioned

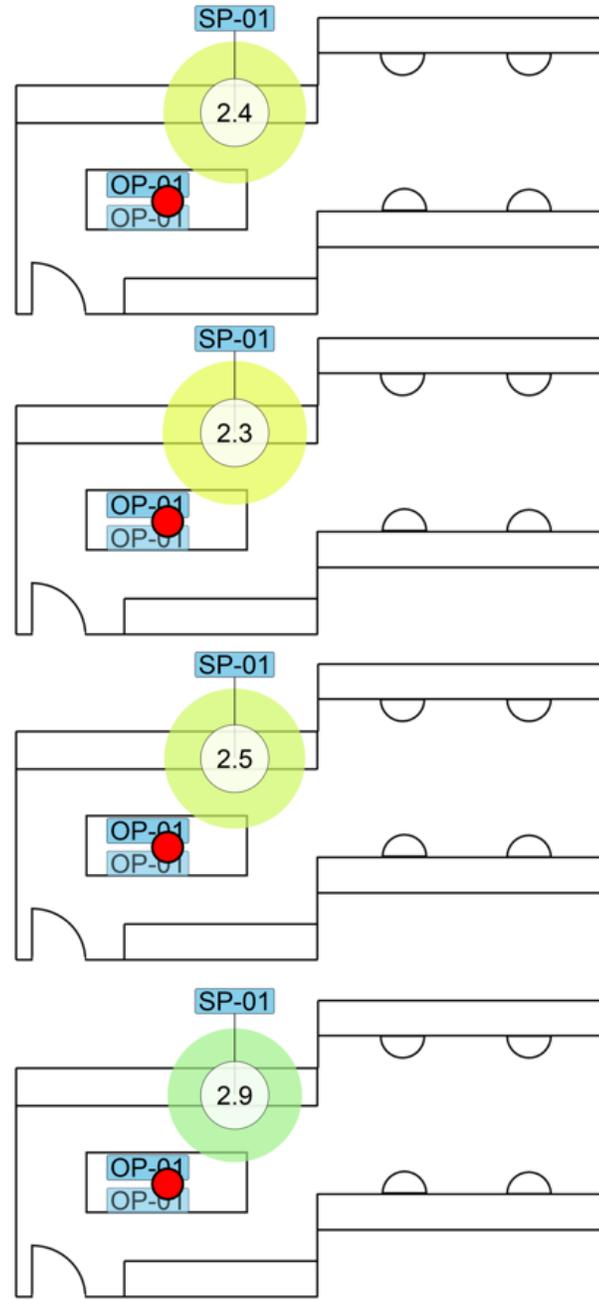
0 - 5 min

5 - 10 min

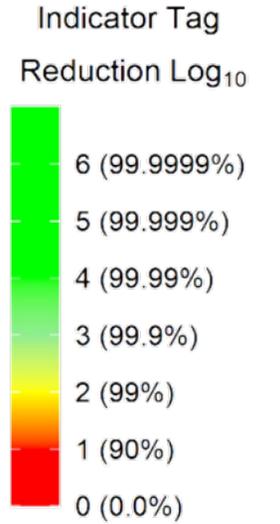
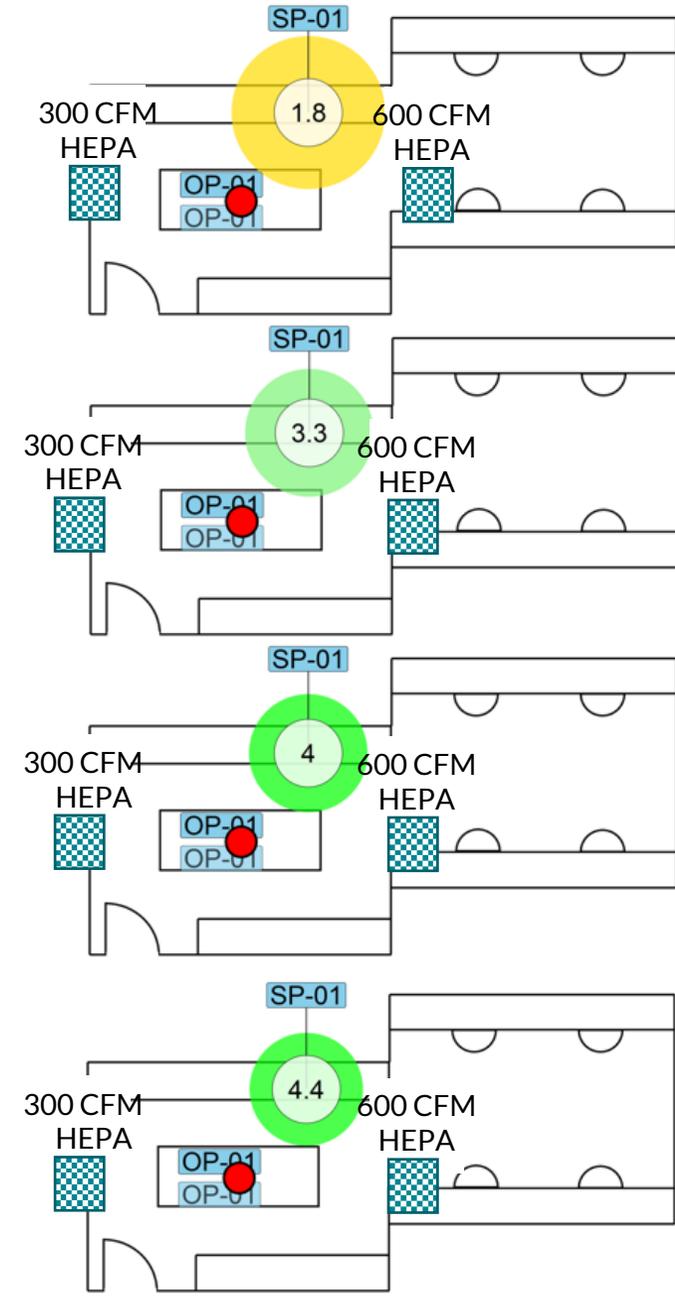
10 - 15 min

15 - 20 min

No HEPA



HEPA (> 10 ACH)



Additional Considerations

Weighing Key Factors Across Facility Portfolios

- Health & Safety ROI vis-a-vis
 - Energy, cost & carbon penalties
 - Capital investment and budgeting
 - Regulatory compliance
 - Liability protection
 - Crisis communications
 - Cost of full or partial shutdowns
- Urgent need for:
 - Independent science-based performance data in the field
 - Ability to baseline test and verify facilities, controls, and strategies
 - Ability to regularly test and verify facilities, controls, and strategies across time

How Do We Verify Indoor Air Safety?

veriDART In Your Toolbox

	veriDART	Basic IAQ Test
Mimics infectious cough/sneeze & particle sizes	X	
Directly measures aerosols to guide operational & scheduling decisions (i.e. time between room occupancy, doors open/closed, windows open/closed)	X	
Provides baseline data that verifies ventilation & filtration efficiency at removing aerosols	X	
Provides data to verify impact of engineering solutions (i.e. use of portable hepa units, increased outside air, increased air exchanged rates) to remove infectious aerosols	X	
Provides data to show duration of aerosol exposure	X	
Provides data to show aerosol movement, concentration, room isolation or room communication	X	
Provides simple graphics to understand data and to use as a communication tool	X	X
Measures PM 2.5, CO2, VOC, Temp, Humidity		X
Associated with operations and maintenance plans	X	X
Compliments Basic IAQ Test & Data	X	



Case Study Come Back with Confidence

IRVINE COMPANY

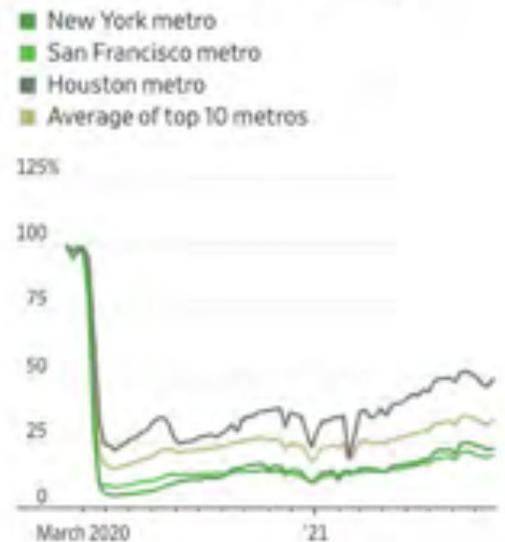
PROBLEM: Public Mistrust in Workplace Safety

Throughout 2020-2021, occupancy levels of US commercial office buildings have stood below 30%.¹

- 42% of workers worry about returning to work for fear of contracting COVID-19²
- Most workers don't trust their leadership to manage return to work and lack confidence in the reliability of pandemic-related information³

Depressed occupancy levels imperil renewals and future leasing levels, representing a major financial risk to commercial real estate owners and operators.

Office occupancy rate by metro area



Source: Kastle Systems

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SOLUTION: 3rd Party Performance Testing of Indoor Air Safety and HVAC Performance

To enhance the health & safety and differentiate its commercial office portfolio, the Irvine Company leveraged SafeTraces' independent science-based performance assessments of its HVAC systems.

SafeTraces' assessment verified two critically important claims for the Irvine Company:

1. Ventilation and filtration systems led to 90% reduction in aerosol concentration within 30 minutes
2. No air exchange was indicated between offices and suites before filtration

OUTCOME: “Come Back With Confidence” Campaign, Verified by SafeTraces

In early 2021, the Irvine Company launched a national “Come Back With Confidence” campaign to promote safe return to office, spotlighting SafeTraces for two reasons:

- Strengthen market leadership in health, safety, and wellness by adopting leading independent, science-based technology to protect tenants
- Publicly share key results from SafeTraces’ assessments to enhance the credibility of their workplace safety claims

This campaign enabled the Irvine Company to outperform its competition in occupancy and leasing levels during the pandemic, while enhancing the competitiveness of their office properties in future leasing decisions.

¹<https://www.wsj.com/articles/office-occupancy-sputtered-in-august-as-delta-variant-foiled-return-to-work-hopes-11631016001>

²<https://www.ehstoday.com/covid19/article/21174103/delta-variant-has-workers-worrying-about-returning-to-office>

³<https://www.edelman.com/research/workplace-trust-coronavirus>



The veriDART® Solution

veriDART is the first and only liquid aerosol-based solution for verifying engineering and HVAC controls, particularly ventilation and filtration, to mitigate airborne exposure risk indoors.

veriDART’s proprietary airborne tracers safely mimic the chemical composition, mobility, and effect of ventilation and filtration for aerosol contaminants to deliver powerful, actionable decision-making analytics. The veriDART adheres to the highest levels of product safety and is well below the OSHA and NIOSH safe exposure limits.

About SafeTraces

SafeTraces is deeply committed to the mission of ensuring the highest safety standards for the food we eat, the medication we take, and the air we breathe. Now more than ever, people demand transparency and assurances from food companies, drug manufacturers, and property managers regarding their safety practices.

Harnessing the power of DNA, SafeTraces has developed groundbreaking solutions for food and drug traceability, sanitation verification, and safe airflow verification that address our fundamental human need for safety. We work tirelessly in support of our clients to advance the cause of making a better, safer world.

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Case Study Cost-Effective Indoor Air Safety

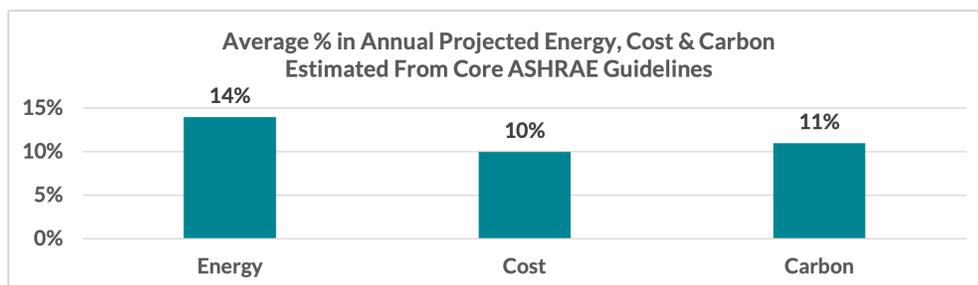
PROBLEM: The Cost Penalty of Safer Indoor Air

During the COVID-19 pandemic, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) guidance has emphasized three significant actions to limit the potential of airborne transmission of SARS-CoV-2 in the built environment:

- Increase outside air (“fresh air”) supplied continuously to occupied spaces
- Increase filtration efficiency in air handling units (AHUs)
- Operate HVAC systems for extended hours to filter/ flush occupied spaces of infectious aerosols at the end of the day and/ or prior to occupancy in the morning

Each action carries a price tag of increased energy consumption - aside from the significant capital cost to implement these changes:

- Increased filter efficiency = higher pressure drop across filters = more energy to push the air harder
- Increased outside air = greater energy consumption due to increased heating and cooling loads
- Operating HVAC after hours = greater energy consumption



Source: JB&B Engineering, “Energy and Carbon in the COVID Era: Lessons Learned on Balancing IAQ.” NY ASHRAE Earth Day Conf., July 2021.

SOLUTION: Optimizing ROI Through Field Verification

To optimize health & safety, financial and sustainability ROI, a large corporate client leveraged SafeTraces’ independent, science-based performance assessments to identify the optimal indoor air safety strategy for its facility portfolio. Absent SafeTraces’ assessment, the client had no other way of measuring the efficacy of its strategy options in its facilities.

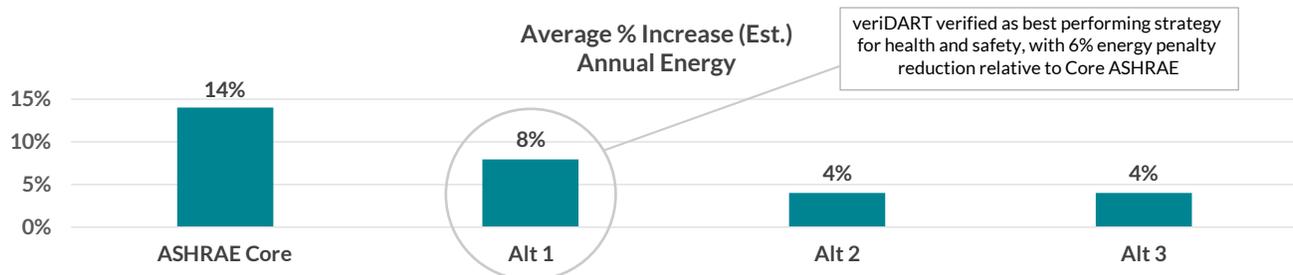
SafeTraces evaluated four different indoor air strategies:

Strategy	Core ASHRAE	Alternative 1	Alternative 2	Alternative 3
Filtration	MERV 13	MERV 13	MERV 13	MERV 15/16
Average OA%	Max OA%	Design OA%	Design OA%	Practical OA%
Flushing	2 hr pre/post occ	3 ACH	3 ACH	3 ACH
UV	-	In unit	-	-
Portable Filtration	-	-	> 3-6 ACH	-

OUTCOME: Maximizing Health & Safety ROI, Minimizing Cost Penalties

SafeTraces' assessment identified Alternative 1 as the best performing strategy for health & safety:

- Most effectively reduces exposure to infectious aerosols
- Carries a 6% lower associated energy penalty relative to the "Core ASHRAE" strategy



Source: JB&B Engineering, "Energy and Carbon in the COVID Era: Lessons Learned on Balancing IAQ." NY ASHRAE Earth Day Conf., July 2021.

SafeTraces' assessment enabled the corporate client to enhance profitability and performance relative to its competitors during the pandemic by:

- Reducing infection risk, absenteeism, and adverse impacts on productivity
- Reducing cost, energy, and carbon penalties across its facility portfolio

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Case Study Effective Disease Transmission Mitigation

PROBLEM: Concern about Ventilation Performance in Schools

Since schools reopened in the fall, students, parents, and schools have operated in uncertain and often unsafe school environments, posing continuous challenges for all:

- Students get sick with COVID-19 or are exposed to infected students
- Parents are confronted with major disruptions to their jobs, childcare needs, and lives
- Faced with lower attendance, schools lose funding, which is based on student numbers and days in attendance

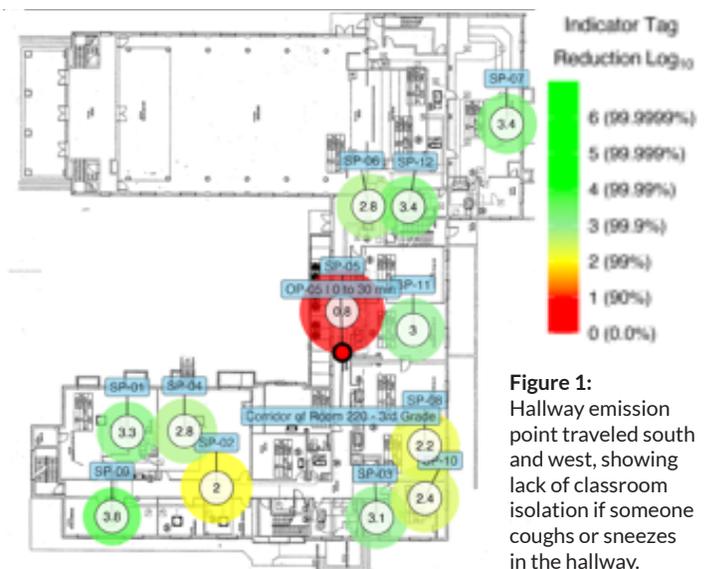
The recent spread of the Delta variant combined with diverging local, state and federal regulations regarding school reopenings has only exacerbated the challenges and uncertainties.

SOLUTION: 3rd Party Performance Testing of CDC-recommended Ventilation Strategies

To verify the effectiveness of measures to reduce disease transmission prior to students returning in the fall of 2021, an Atlanta-based pre-K-8 school leveraged SafeTraces' independent science-based performance assessment of their HVAC systems.

SafeTraces' assessment revealed that some measures taken at the school to reduce transmission risk were in fact increasing the risk, including:

- The CDC-prescribed method of simultaneously opening classroom doors and windows actually led to contaminants being drawn deeper into the building.
- Based on the HVAC system's architecture, distinct connections between some rooms were identified for further investigation and modification to prevent air from a potentially infected area being carried into other rooms. See Figure 1.



- Dilution tests determined that room-level ventilation and filtration provided by the building's HVAC units required additional filtration. See Figure 2.

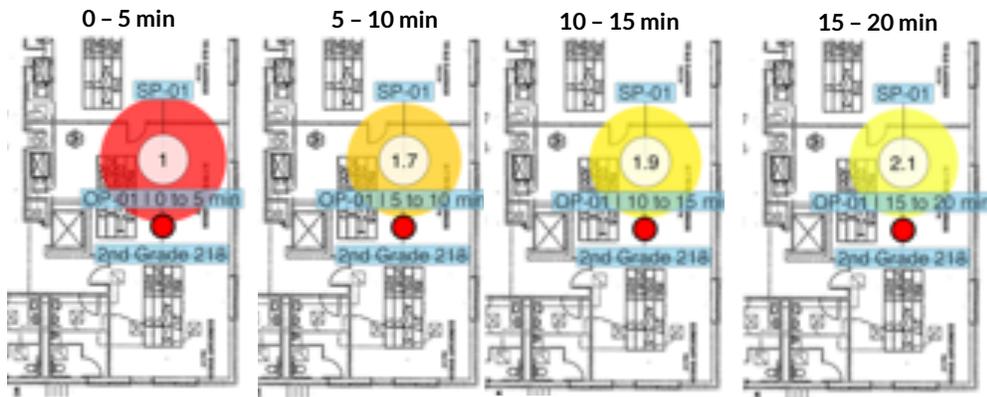


Figure 2: Classroom emission point did not reach a 3 log reduction or 99.9% removal of aerosols within the 20 minute sampling period. Supplemental portable HEPA units were recommended.

OUTCOME: Course Correction for More Effective Ventilation Performance

Using SafeTraces' assessment, the school took immediate remedial action as well as prioritized additional investments to reduce transmission risk:

- Instead of leaving both doors and windows open, the school changed protocols to leave windows open and classroom doors closed, minimizing disease spread to other parts of the building.
- The school ordered properly-sized HEPA filters to maximize dilution in classrooms.
- The school is implementing modifications to the HVAC system and settings to reduce transmission of infected air across rooms via the HVAC air ducts.

Empowered with SafeTraces' science-based analysis, the school quickly identified and remediated safety hazards, protected students and staff to ensure more in-school instruction, and more effectively directed available funds.

The veriDART® Solution

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veriDART's proprietary airborne tracers safely mimic the chemical composition, mobility, and effect of ventilation and filtration for aerosol contaminants to deliver powerful, actionable decision-making analytics.

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Case Study Mitigating Infection Risk in Long-Term Care Facilities



PROBLEM: Reducing Aerosol Transmission Rates in Congregate Care Settings

Long-term care facilities (LTCFs) have traditionally been particularly vulnerable to infectious diseases due to the high-risk status of their population as well as the nature of congregate care settings.

- After accounting for about 50% of all US COVID-related deaths at the start of the pandemic¹, LTCF residents and staff still account for over 23% of all COVID-19 related deaths as of January 2022.²
- The recent pandemic surge shows that despite high vaccination rates (87% of residents and 83% of staff are fully vaccinated as of February 2022³) and improved infection control procedures, LTCFs continue to experience high case rates that require meaningful, sustainable risk mitigation procedures. (Fig. 1)

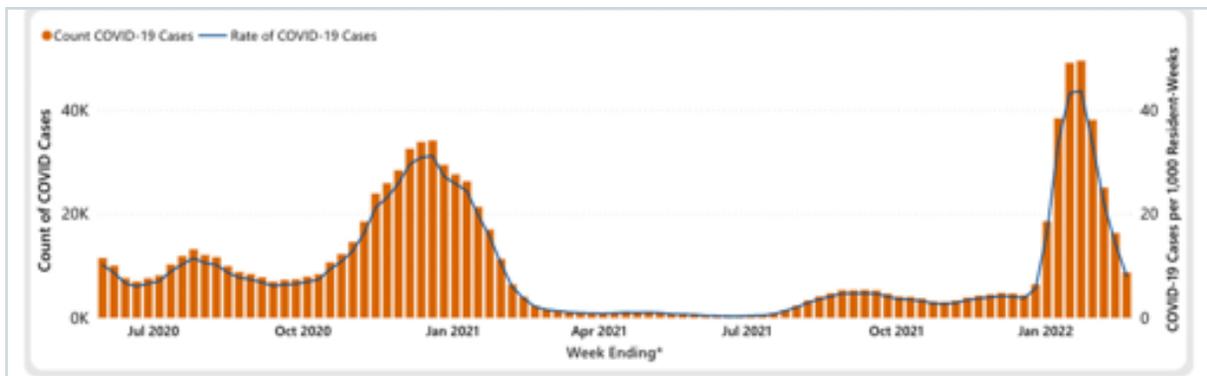


Figure 1: CDC National Healthcare Safety Network. Confirmed COVID-19 Cases among Residents and Rate per 1,000 Resident-Weeks in Nursing Homes, by Week - United States.²

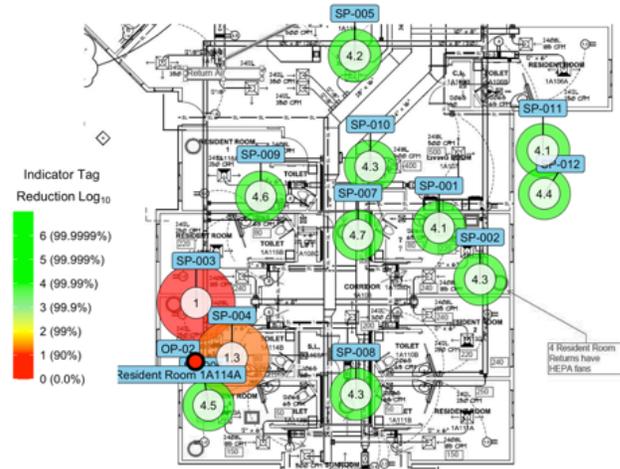
Existing HVAC systems pose significant risks for LTCFs as they aim to reduce infection and death rates by setting up isolation wards and clearly separating rooms from common areas.

- In many facilities, HVAC systems are shared among resident rooms and foyers, common areas, or nursing stations, indicating a high aerosol transmission risk.
- Performing central HVAC systems upgrades to separate spaces and create effective isolation wards can be time-consuming and cost-prohibitive.
- To reduce the aerosol transmission risk quickly and cost-effectively, LTCFs need to assess alternative modifications, including adjusting ventilation rates and directional airflow (e.g., pressure relationships), and establishing airflow barriers between spaces.

SOLUTION: Mitigating Airborne Transmission Risk with Effective Isolation

A US nursing home leveraged a series of science-based veriDART® assessments across its patient rooms, and staff and common areas to verify effective aerosol removal in an area that was being retro-fitted and retro-commissioned for greater infection control. (Fig. 2)

Figure 2: Example Survey Tests results in a newly created isolation ward showed that patient rooms were well ventilated with in-room HEPA units and well isolated from the common and staff areas with added anterooms and barriers.



OUTCOME: Assessing HVAC Performance Inside Separate Isolation Ward Spaces

Based on the results, the nursing home verified an effective mitigation plan for its isolation ward, dividing it into well isolated patient rooms, and staff and common areas. (Fig. 3)

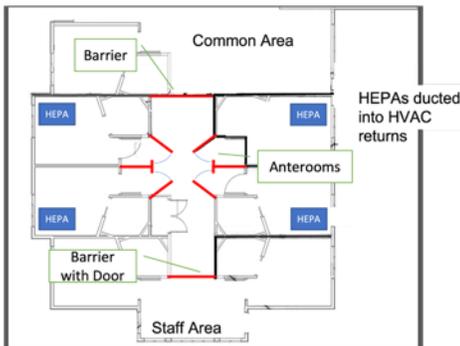


Figure 3: Isolation ward mitigation diagram

- **Patient rooms:** assessments verified that adding stand-alone HEPA units to the rooms that duct directly into the return vent created negative pressure for effective room isolation while preserving air quality of the return air to prevent recirculation of contaminated air.
- **Anterooms:** assessments measured effective aerosol removal to provide isolated space outside the patient rooms with only one door is open at a time.
- **Staff and common areas:** assessment measured that a physical barrier separating the common and staff areas provided effective isolation of these areas from the patient rooms.

Using veriDART, this long-term care facility verified that their modest-cost and quick-to-install upgrades enabled it to safely use its existing patient ward as an isolation ward for COVID patients.

¹<https://www.kff.org/policy-watch/over-200000-residents-and-staff-in-long-term-care-facilities-have-died-from-covid-19/#:~:text=From%20COVID%2D19,Over%20200%2C000%20>

²<https://www.cdc.gov/nhsn/covid19/ltc-report-overview.html>

³<https://data.cms.gov/covid-19/covid-19-nursing-home-data>

The veriDART® Solution

veriDART is the first diagnostic solution for verifying ventilation and filtration performance using patented aerosol tracing technology.

veriDART's aerosol tracers safely mimic pathogen mobility and exposure for performance verification and management of HVAC systems to deliver actionable decision-making analytics.

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Case Study Reducing Hospital-Acquired Infections

PROBLEM: Hospital-Acquired SARS-CoV-2 Infections

The hospital-acquired COVID-19 infection rate is estimated at 12-15%.¹ Despite being designed, operated, and regulated to mitigate infection risk, healthcare facilities have confronted unprecedented challenges and strains during the pandemic due to:

- High transmissibility of SARS-CoV-2, primarily via respiratory droplets and aerosols
- High incidence of asymptomatic infection further increasing transmission risk
- High caseloads of infected patients overrunning isolation room capacity

Moreover, COVID-19 directly contributed to an increase in hospital-acquired infections across the U.S., attributable to “more and sicker patients requiring more frequent and longer use of catheters and ventilators, as well as staffing and supply challenges according to data reported to the National Healthcare Safety Network.”²

This increase has reversed years of sustained reductions in hospital-acquired infections,³ amidst several other significant challenges facing in U.S. hospitals in 2021:

- \$54 billion in estimated net income losses⁴
- 500,000 healthcare workers quitting in August (the most in a single month in more than 20 years)⁵
- Rapidly increasing regulatory compliance requirements including the enactment of permanent COVID-19 standards⁶, increased enforcement activity from OSHA’s National Emphasis Program focused on high-hazard industries like healthcare⁷, and the looming potential for an infection control rule to be issued by OSHA.⁸

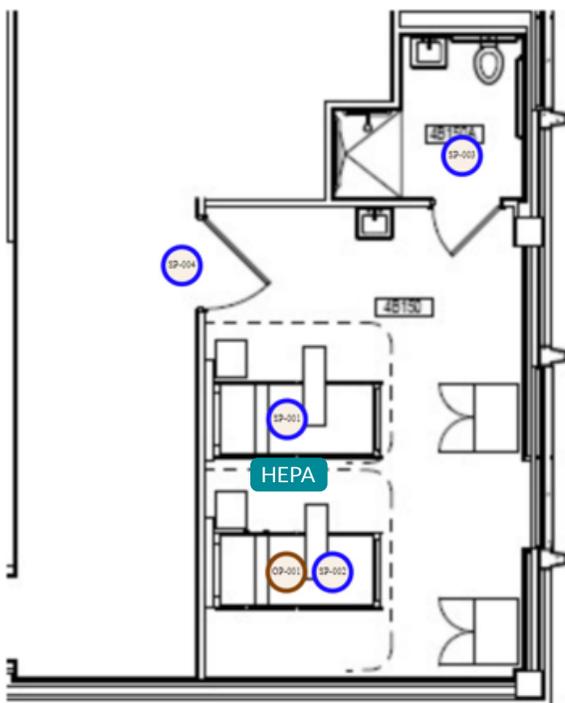
SOLUTION: Verifying Indoor Air Safety in Double-Occupancy Patient Rooms

To mitigate airborne transmission risk of SARS-CoV-2 and other respiratory diseases, a major hospital client leveraged SafeTraces’ independent, science-based performance assessments to identify the optimal indoor air safety strategy for its double-occupancy patient rooms. Absent SafeTraces’ assessment, the client had extremely limited ability to measure the efficacy of its strategy options in the field.

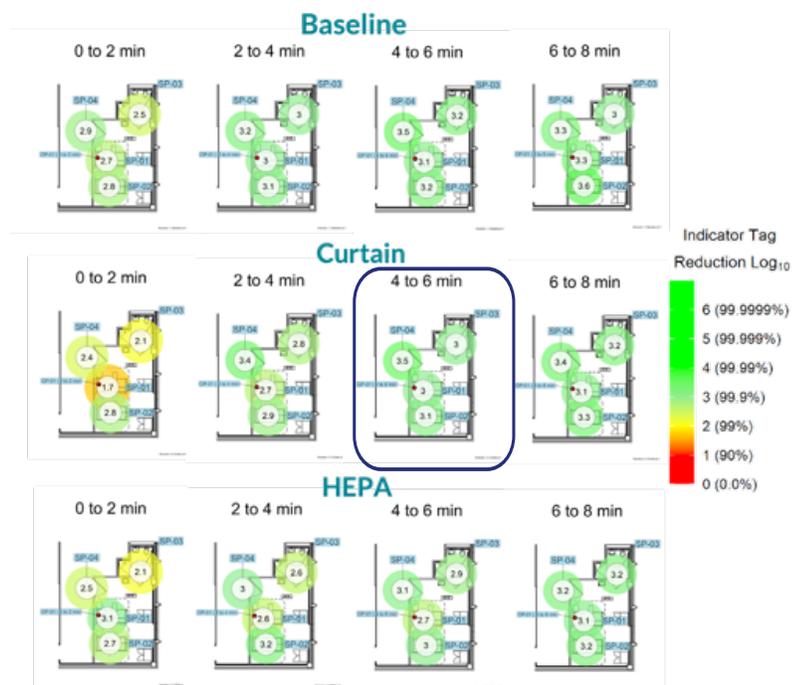
SafeTraces evaluated three options on behalf of the hospital client:

- **Scenario 1:** Centrally provided ventilation and filtration
- **Scenario 2:** Scenario 1 conditions with a curtain dividing two patient beds
- **Scenario 3:** Scenario 1 conditions with a portable HEPA filtration device

Recent scientific research has indicated positive effects of portable HEPA filtration devices, particularly for general hospital wards being repurposed into surge wards and intensive care units (ICU's).⁹ The hospital client's central question therefore was whether centrally provided ventilation and filtration was adequate or if supplementing with portable HEPA filtration devices was justified on health & safety and financial grounds.



Double occupancy room configuration, with red circle denoting simulated respiratory emission of infected patient and blue circles denoting simulated respiratory exposures.



Scenario 2 with Curtain (4 to 6 minutes) was the first to clear aerosols by 99.9% at all sample points.

OUTCOME: Maximizing Health & Safety and Financial ROI

SafeTraces' assessment identified Scenario 2 as the best performing strategy through simulated respiratory emissions of infected patients in each of the two beds – centrally provided ventilation and filtration, which was able to achieve 13 ACH in the patient room, with the curtain closed delivered comparable performance results to the portable HEPA filtration device.

However, testing revealed that the portable HEPA filtration device chosen for the assessment had not been optimally sized and specified for the room relative to other better-suited models. In our experience, clients commonly make this mistake with portable HEPA filtration devices, an error which can be easily detected and corrected by a SafeTraces' assessment.

SafeTraces' assessment enabled the hospital client to identify the best performing strategy to:

- Reduce infection risk to patients and staff
- Spend financial resources cost-effectively
- Meet rapidly increasing federal and state regulatory compliance requirements for ventilation safety during the COVID-19 pandemic and beyond

¹<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7827479/pdf/ijerph-18-00489.pdf>

²<https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/impact-of-coronavirus-disease-2019-covid19-on-healthcare-associated-infections-in-2020-a-summary-of-data-reported-to-the-national-healthcare-safety-net-work/8197F323F4840D233A0C62F4726287E1>

³<https://www.healthcarefinancenews.com/news/covid-19-increased-number-healthcare-associated-infections>

⁴<https://www.aha.org/system/files/media/file/2021/09/AHA-KH-Ebook-Financial-Effects-of-COVID-Outlook-9-21-21.pdf>

⁵<https://www.politico.com/news/2021/10/20/hospitals-labor-shortage-covid-delta-516303>

⁶<https://www.ehstoday.com/covid19/article/21176983/california-drafts-permanent-covid-rules>

⁷https://www.osha.gov/sites/default/files/enforcement/directives/DIR_2021-01_CPL-03.pdf

⁸<https://www.osha.gov/infectious-diseases/rulemaking>

⁹<https://www.medrxiv.org/content/10.1101/2021.09.16.21263684v1.full>

The veriDART® Solution

veriDART is the first and only liquid aerosol-based solution for verifying engineering controls and HVAC performance, particularly ventilation and filtration, to mitigate airborne exposure risk indoors.

veriDART's proprietary airborne tracers safely mimic the chemical composition, mobility, and effect of ventilation and filtration for aerosol contaminants to deliver powerful, actionable decision-making analytics.



About SafeTraces

SafeTraces is deeply committed to the mission of ensuring the highest safety standards for the air we breathe, the food we eat, and the medication we take. Harnessing the power of DNA, SafeTraces has developed groundbreaking solutions for safe airflow verification, food and drug traceability, and sanitation verification that address our fundamental human need for safety. We work tirelessly in support of our clients to advance the cause of making a better, safer world.

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veriDART[®] Customers & Partners Snapshots



Deployed Across Enterprise Real Estate

> 1,000 Completed Assessments For Leading Corporate, Commercial, and Institutional Clients

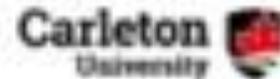
Corporate Real Estate



Commercial Real Estate



Higher Ed & K-12



Public Institutions



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