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2022 Partner Exchange

IEQ: Planning for a Variable Future

September 19, 2022

Speakers

Jeff Wiseman
Indoor Air Quality Portfolio Leader

Chris Hsieh
Application Engineering

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AGENDA

- What is Indoor Environmental Quality (IEQ)?
- Shifting expectations for buildings
- Indoor Air Quality (IAQ)
- Considering traditional technologies and planning for emerging technologies
- Monitoring and controlling Indoor Air Quality

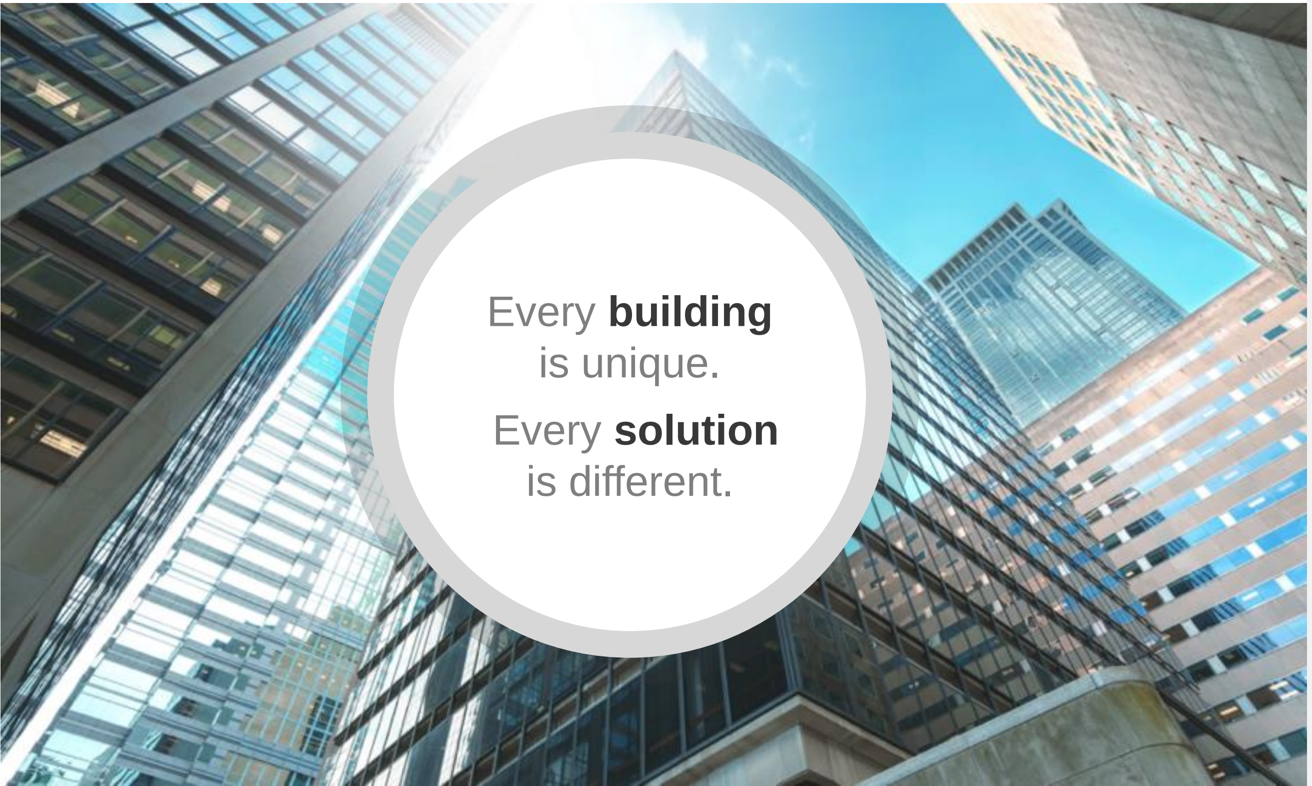
The Four Elements of IEQ

Technology will continue to advance and accelerate to optimize healthier and more efficient spaces

Recommended Approach

Taking a holistic view

A building's interconnected systems and the interactions between those systems result in an occupant experience that is influenced by IEQ.



ASSESS

- Analyzing current state/determining needs
- Projecting the future of the space

MITIGATE

- Developing occupant-centric strategies
- Implementing the solutions
- Improving energy efficiency and sustainability

MANAGE

- Ongoing optimization
- Continuous managing and monitoring

How have expectations changed for buildings?

Pandemic has put emphasis on IAQ

- Engineers used to design for efficiency (minimize outdoor air)…
  ASHRAE® 62.1 IAQp
- Increasing outdoor air for enhanced air quality conditions may change your design considerations

The future of work has changed with hybrid and work-from-home models

- Occupants have choices about where and how to work, shop, eat, etc.
- Occupants may be more focused on comfort, health, and safety than ever before
- Employers are competing for talent, and enhanced IEQ may influence a candidate’s decision

A building’s value will be increased by how well it can meet the demands of occupants and manage variability in its spaces

Increasing adoption of building health and wellbeing certifications

International Well Building Institute™

- *WELL Health-Safety Rating™*
- *WELL Performance Rating™*
- *WELL Certification™*

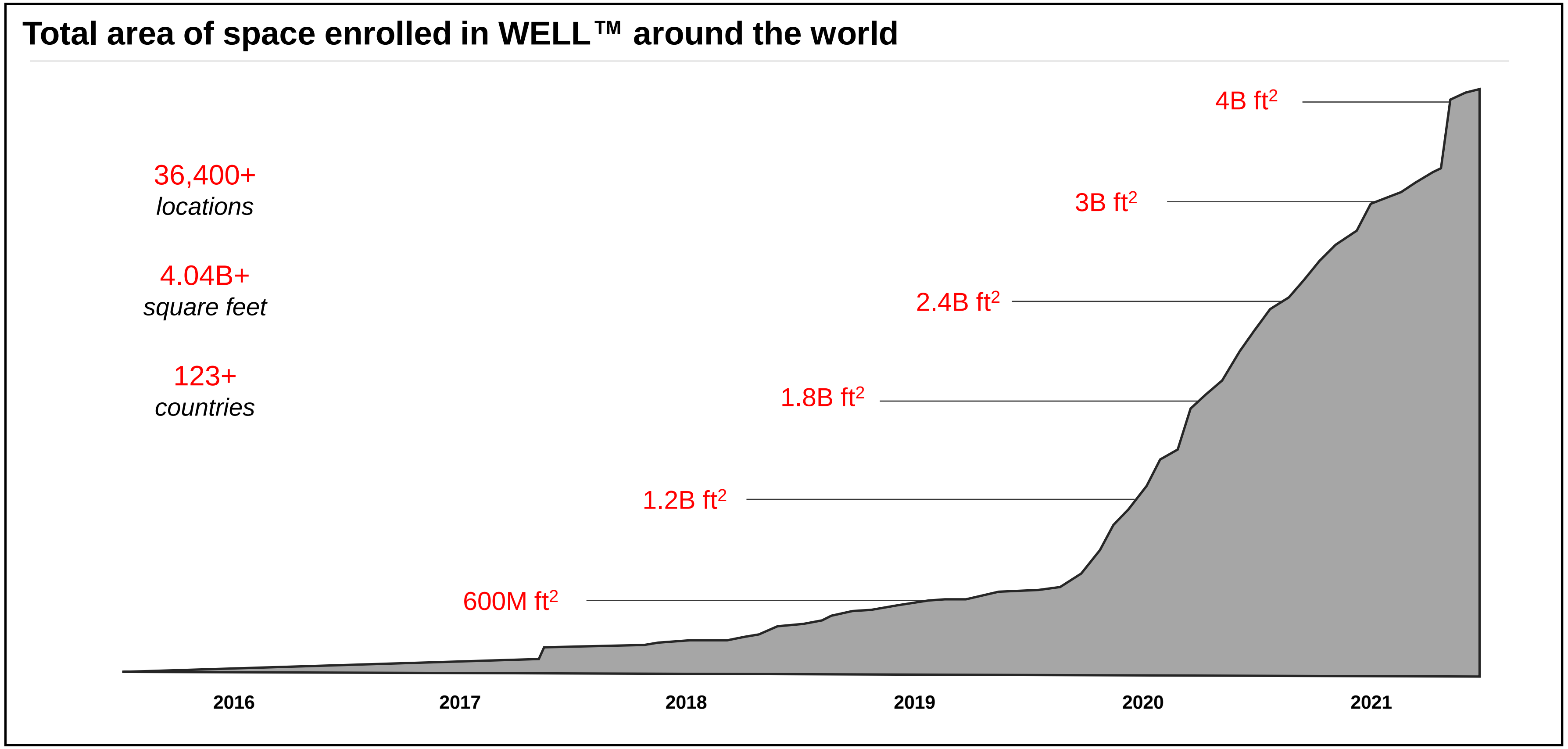
Center For Active Design™

- *Fitwel® Certification*

- IAQ and IEQ contribute points towards health and wellbeing ratings
- Certification typically includes areas beyond IEQ… water quality, nutrition, mental health/support, exercise and fitness, work-life balance, etc.
- Costs, requirements and validation period varies based on certification programs
  - Costs can range from $500 to $70K+ per building

Significant increase in WELL™ certification adoption

TRANE



Source, 8/18/22: https://www.wellcertified.com/well-at-scale

As of August 18, 2022, there were **14,802 buildings** in the US and Canada with over **3.7B ft²** that have earned, or in the process of earning, WELL certification

Source, 8/18/22: https://v2-api.wellcertified.com/api/project-directory/excel

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ASHRAE® 62.1 Update

- Purpose of 62.1 standard is to specify minimum ventilation rates and other measures intended to provide indoor air quality that is acceptable to human occupants and that minimizes adverse health effects.

- 62.1 also includes Indoor Air Quality Procedure(IAQP) that allows a reduction in ventilation based on two evaluations
  1. Identification and control of "contaminants of concern" (defined by the designer)
  2. Occupant survey

- In February 2022, ASHRAE adopted addendum aa to 62.1 - 2019 by specifying 14 design compounds and PM2.5 that must be controlled when utilizing IAQP

Addendum aa Design Compounds , PM2.5 and Their Design Limits

Table 6-5 Design Compounds, PM2.5, and Their Design Limits

Compound or PM2.5	Cognizant Authority	Design Limit
Acetaldehyde	Cal EPA CREL (June 2016)	140 µg/m³
Acetone	AgBB LCI	1,200 µg/m³
Benzene	Cal EPA CREL (June 2016)	3 µg/m³
Dichloromethane	Cal EPA CREL (June 2016)	400 µg/m³
Formaldehyde	Cal EPA 8-hour REL (2004)	33 µg/m³
Naphthalene	Cal EPA CREL (June 2016)	9 µg/m³
Phenol	AgBB LCI	10 µg/m³
Tetrachloroethylene	Cal EPA CREL (June 2016)	35 µg/m³
Toluene	Cal EPA CREL (June 2016)	300 µg/m³
1,1,1-trichloroethane	Cal EPA CREL (June 2016)	1000 µg/m³
Xylene, total	AgBB LCI	500 µg/m³
Carbon monoxide	USEPA NAAQS	9 ppm
PM2.5	USEPA NAAQS (annual mean)	12 µg/m³
Ozone	USEPA NAAQS	70 ppb
Ammonia	Cal EPA CREL (June 2016)	200 µg/m³

Focusing on Indoor Air Quality

How Do You See What You Can't See

How do you help ensure optimal indoor air quality?

How do you make people feel comfortable and confident in your space?

How do you know the efforts are working?

How do you share results with people?

A building's value will be impacted by how well it can meet the demands of occupants and manage variability in its spaces

What's In Your Air?

	Temperature	Humidity	Particulate Matter	Carbon Dioxide	Volatile Organic Compounds
Abbreviation	°F / °C	rH	PM	CO_2	VOCs
What it is:	How warm or cold the room is	The moisture in the air; feeling dry or clammy	Dust, soot, smoke, and other fine debris in the air	The byproduct of many people breathing in a room	Odors and byproducts from cleaning products or other toxic airborne chemicals
How it impacts occupants and buildings:	Temperature has an impact on comfort, productivity, and human health.[1]	Humidity has an impact on comfort, and can contribute to the growth of mold, certain viruses, and bacteria.[2]	Particulate matter can trigger respiratory problems like asthma or allergies.[3]	Too much carbon dioxide can impact cognitive performance and decision making.[4]	Exposure to VOCs can lead to respiratory and skin irritation, and odors can make a space unpleasant.[5]

A sensor-enabled air quality audit can help you understand and address specific IAQ issues that are unique to your space.

The Four Key Pillars of IAQ

Dilute	Exhaust	Contain	Clean
Making sure plenty of fresh outdoor air dilutes the buildup of indoor contaminants through proper ventilation	Getting exhaust air out is equally important, especially air from kitchens, restrooms, and combustion systems	Keeping indoor humidity levels within the ASHRAE®-recommended range maximizes occupant comfort and reduces the risk of microbial growth	Reducing particles, odors, or micro-organisms (such as mold, bacteria, and certain viruses)

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Reducing particles, odors, or micro-organisms (such as mold, bacteria, and certain viruses)

Dilute: Increase Outdoor Air to Dilute Indoor Contaminants

- Ensure at least code-required design outdoor airflow whenever occupied (ASHRAE® Standard 62.1)
- Disable demand-controlled ventilation (DCV)
- Consider increasing outdoor airflow, if possible, when outdoor conditions allow
- Consider implementing pre- and post-occupancy purge sequences to flush building with outdoor air

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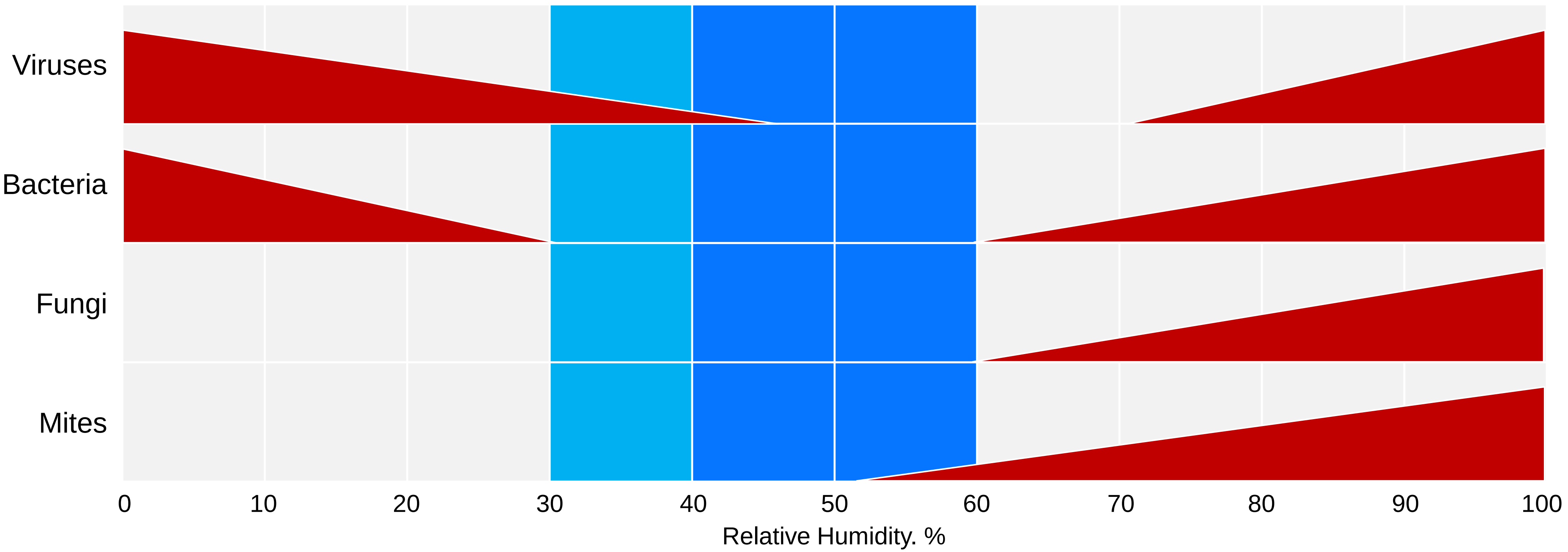
Contain: Humidity Control – Helps Reduce Viral Load and Lessen Impact

Viruses are typically less stable between RH of 40-60%



Information from 2016 ASHRAE® Handbook. HVAC Systems and Equipment

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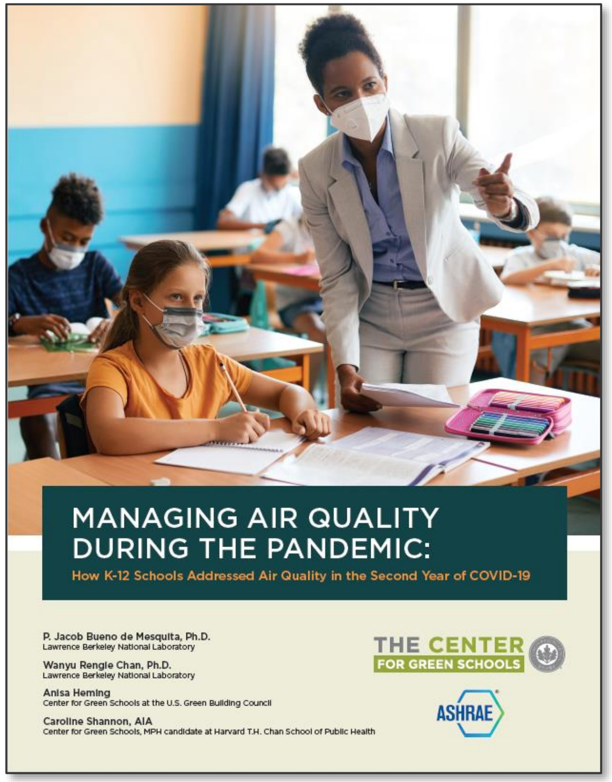
Challenges with existing HVAC systems

Many buildings are not capable of implementing recommended IAQ measures *(Increased OA, MERV13+, etc.)*

Recent survey from LBNL and The Center for Green Schools *(May 5, 2022):*



We found that:

- School districts prioritized increasing outdoor air intake. Increasing outdoor air through HVAC systems was the most prevalent building engineering control measure taken, followed by opening windows.
- Similar to the last report, the top challenge for schools in implementing many of the recommended indoor air quality (IAQ) measures was that buildings' HVAC systems were not designed to implement the recommendations.
- School district characteristics such as demographics, locale, and size were not associated with the number of IAQ measures taken, but were associated with the implementation of specific measures, such as increasing outdoor air through HVAC systems and assessing outdoor air delivery.

MANAGING AIR QUALITY DURING THE PANDEMIC:
How K-12 Schools Addressed Air Quality in the Second Year of COVID-19 — 1

https://www.ashrae.org/File%20Library/Technical%20Resources/COVID-19/Managing_Air_Quality_During_the_Pandemic.pdf

ASHRAE® ETF Recommendations for Ventilation, Filtration, Air Cleaning

ASHRAE

ASHRAE EPIDEMIC TASK FORCE

Core Recommendations for Reducing Airborne Infectious Aerosol Exposure

The following recommendations are the basis for the detailed guidance issued by ASHRAE Epidemic Task Force. They are based on the concept that within limits ventilation, filtration, and air cleaners can be deployed flexibly to achieve exposure reduction goals subject to constraints that may include comfort, energy use, and costs. This is done by setting targets for equivalent clean air supply rate and expressing the performance of filters, air cleaners, and other removal mechanisms in these terms.

1. *Public Health Guidance* - Follow all regulatory and statutory requirements and recommendations for social distancing, wearing of masks and other PPE, administrative measures, circulation of occupants, reduced occupancy, hygiene, and sanitation.

2. *Ventilation, Filtration, Air Cleaning*
   2.1 Provide and maintain at least required minimum outdoor airflow rates for ventilation as specified by applicable codes and standards.
   2.2 Use combinations of filters and air cleaners that achieve MERV 13 or better levels of performance for air recirculated by HVAC systems.
   2.3 Only use air cleaners for which evidence of effectiveness and safety is clear.
   2.4 Select control options, including standalone filters and air cleaners, that provide desired exposure reduction while minimizing associated energy penalties.

3. *Air Distribution* - Where directional airflow is not specifically required, or not recommended as the result of a risk assessment, promote mixing of space air without causing strong air currents

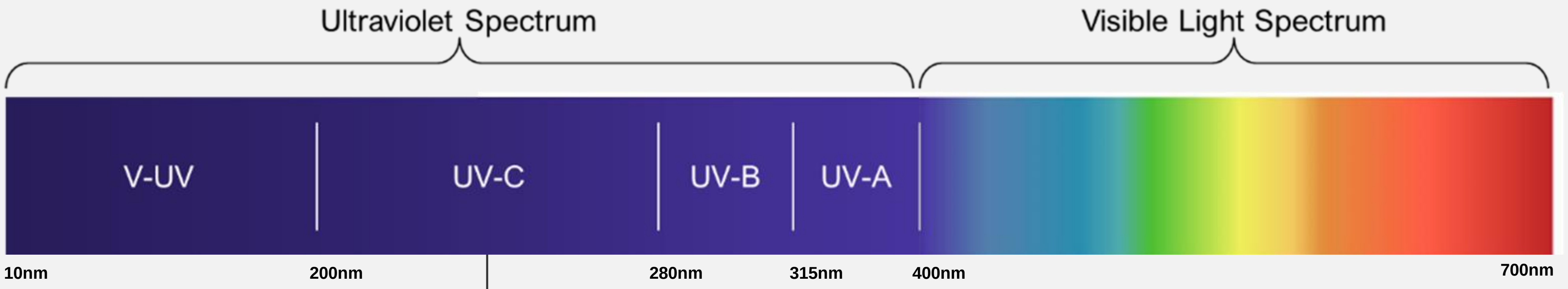
https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf

Ultraviolet Germicidal Irradiation (UVGI)

Ultraviolet Germicidal Irradiation (UVGI)

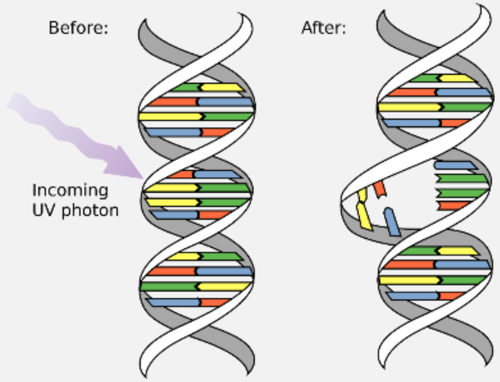
TRANE

UVGI uses short wavelength ultraviolet light (UV-C) to inactivate microorganisms… destroys nucleic acids altering the structure of the RNA.



UVGI

- 254nm
- Up to 99.9% effective at inactivating microorganisms
- Known exposure risks (skin and eyes)
- Can degrade organic materials
  - *electrical insulation*
  - *elastomers and sealants*
  - *filter media*
  - *gaskets and pipe insulation*
  - *furnishings and finishes*



Source: https://commons.wikimedia.org/wiki/File:DNA_UV_mutation.svg

Ultraviolet Germicidal Irradiation (UVGI)

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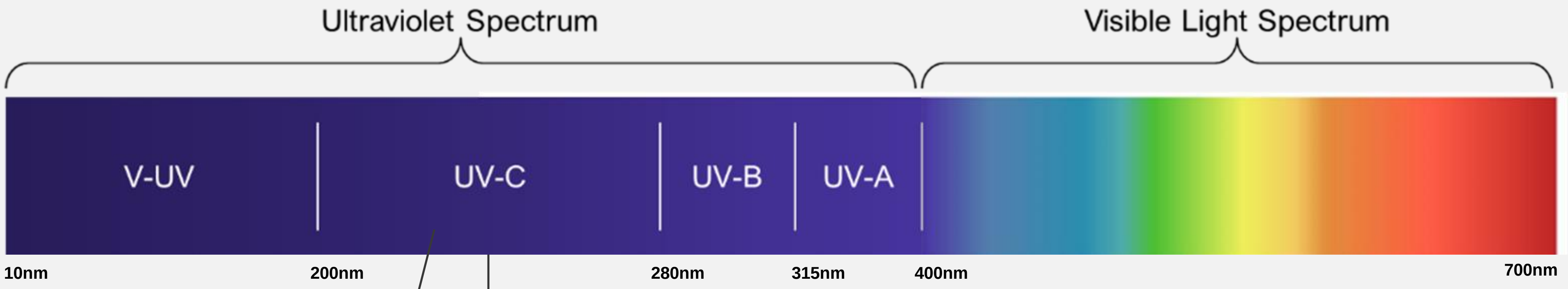

Far UV
- 222nm
- New technology
- Early tests indicate effective at inactivating microorganisms
- Unknown exposure risks

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- Up to99.9% effective at inactivating microorganisms
- Known exposure risks (skin and eyes)
- Can degrade organic materials
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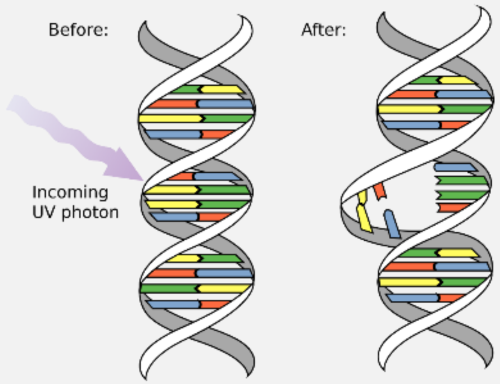


Source: https://commons.wikimedia.org/wiki/File:DNA_UV_mutation.svg

How Does It Work?

UVGI efficacy is dependent on the UV dose… dosage required for inactivation varies by microorganism.

UV Dose = irradiance x time

Amount of light energy… irradiance decreases as you move further away from the light

Dwell time… how long the microorganism is exposed to the irradiance

Use URV ratings to determine UV intensity for pathogen kill rates

URV	Dose ($\mu J/cm^2$)	Influenza (virus variant)	Smallpox (virus variant)	Tuberculosis (gram-positive bacteria)
1	1	0	0	0
2	10	1	2	2
3	20	2	3	4
4	30	3	4	6
5	50	6	7	10
6	75	9	11	15
7	100	11	14	19
8	150	16	20	27
9	250	26	32	41
10	500	45	53	66
11	1,000	69	78	88
12	1,500	83	90	96
13	2,000	91	95	99
14	3,000	97	99	100
15	4,000	99	100	100
16	5,000	100	100	100
17	6,000	100	100	100
18	8,000	100	100	100
19	10,000	100	100	100
20	20,000	100	100	100

UVGI recommendation

ASHRAE recommends 1,500 μJ/cm^2 for 99% inactivation of SARS-CoV-2 in air

Details on the UV Dose Recommendation for SARS-CoV-2

- A minimum UV-C (254 nm) dose of 611 μJ/cm^2 should be applied for 90% inactivation of SARS-CoV-2. This extrapolates to a dose of 1222 μJ/cm^2 for 99% inactivation of SARS-CoV-2 virus in air applications.
- It is advisable to build in appropriate safety margins to account for different environmental conditions such as air flow speeds, temperature and humidity levels, number of air changes, surface soiling, lamp ageing and system configuration, etc. A conservative minimum UV-C (254 nm) dose value of 1,500 μJ/cm^2 is therefore suggested for 99% inactivation of SARS-CoV-2 in air.

https://www.ashrae.org/technical-resources/filtration-disinfection#uvc

Use URV ratings to determine UV intensity for pathogen kill rates

			Smallpox (virus variant)	Tuberculosis (gram-positive bacteria)
			0	0
			2	2
			3	4
			4	6
			7	10
			11	15
			14	19
			20	27
			32	41
			53	66
[illegible]	[illegible]	[illegible]	78	88
12	1,500	83	90	96
13	2,000	91	95	99
14	3,000	97	99	100
15	4,000	99	100	100
16	5,000	100	100	100
17	6,000	100	100	100
18	8,000	100	100	100
19	10,000	100	100	100
20	20,000	100	100	100

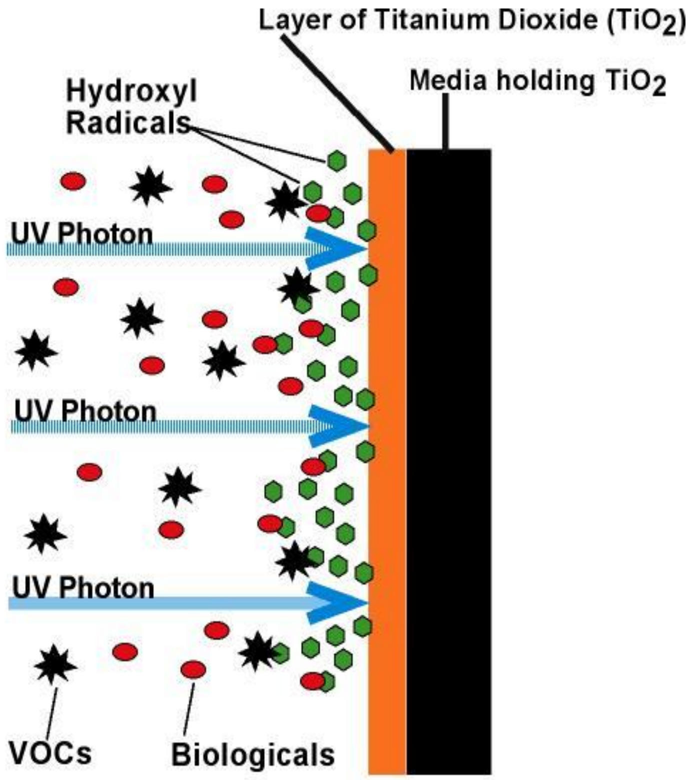
UVC light bulbs may have special disposal requirements

Photocatalytic Oxidation

Trane Catalytic Air Cleaning System (TCACS)

Photocatalytic Oxidation

- **UVGI:** UV radiation penetrates microorganisms and damages nucleic acids altering the structure of the RNA/DNA
- **Photocatalytic Oxidation (PCO):** UV photons react with a TiO_2 catalyst to create hydroxyl radicals (short-lived, powerful oxidizing agent)
  - UV light creates photons, a form of light energy
  - Photons are "catalyzed" by the TiO_2 forming hydroxyl radicals
  - Radicals last a fraction of a second and react with carbon-based compounds
  - Organic compounds (anything with a carbon atom) can be reduced to CO_2 and H_2O



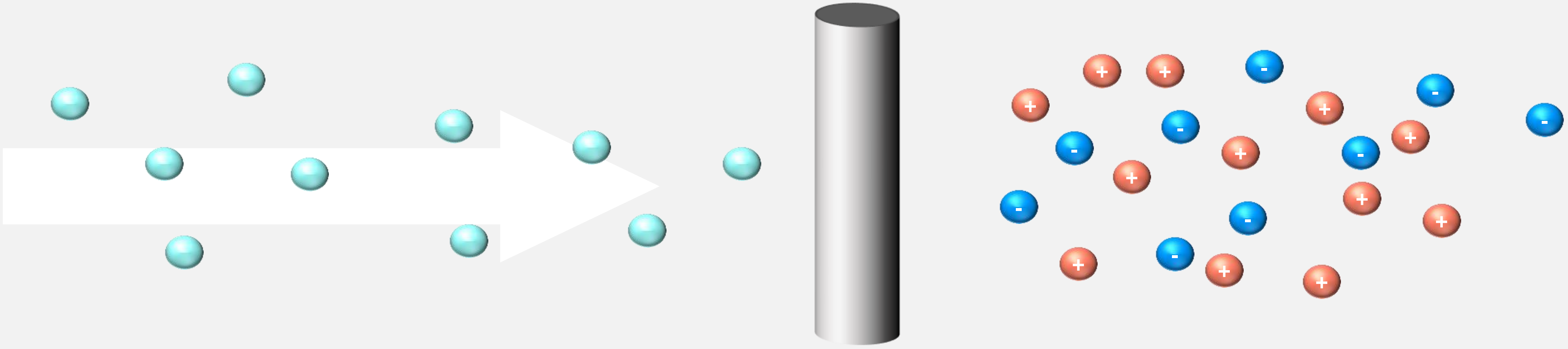
Source: Genesis Aire

Bipolar Ionization

What is Bipolar Ionization?

Bipolar ionizers (BPI) are an in-duct or in-AHU device that creates a plasma field of charged molecules (ions)

- Plasma is 1 of the 4 states of matter in addition to solids, liquids, and gases and consists of a gas of ions and free electrons
- Ions can attach to small airborne dust particles, causing some particles to be negatively charged and others to be positively charged
- Oppositely charged dust particles stick together to form larger particles (called agglomeration) resulting in dust with larger surface areas and mass making them easier to capture in filters (or collecting on surfaces in the rooms)
- Most ions created from BPI have short half-lives (<60 sec)… the plasma field typically reaches 3 – 5 ft. from the device



Bipolar Ionization Devices

Bipolar Ionization Systems

(also called Corona discharge ionization or Plasma tubes)

- Constructed of an inner filament, a glass tube, and an outer filament
- Voltage and current must be high enough to pass through the dielectric material (glass tube)… resulting in a corona discharge
- Ozone may be created with the corona discharge

Needlepoint Bipolar Ionizers

(NPBI™)

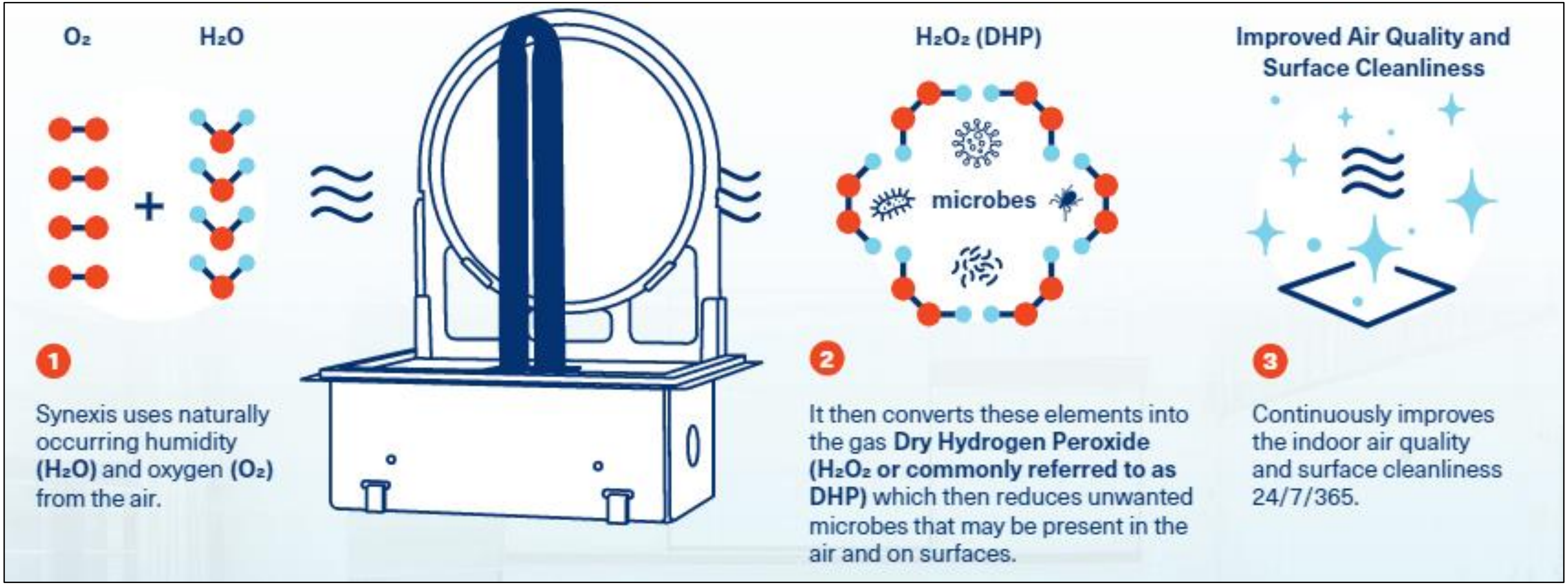
- NPBI consists of "needles" of carbon fiber, titanium, silver, gold, stainless steel, or any other corrosion resistant and conductive material
- Many NPBI devices are now UL 2998 certified… considered ozone free (O_3 < 5 ppb)

Source: Global Plasma Solutions, "An Overview of Needlepoint Bipolar Ionization." Feb 2019

Dry Hydrogen Peroxide (DHP)

Synexis® BioDefense System

Synexis® Dry Hydrogen Peroxide



Technology Comparison

Clean: Cleaning Technology Efficacy

To better understand and describe our IAQ Cleaning Technology portfolio, testing was conducted at a third-party lab to determine the efficacy of the individual technologies

- LMS Technologies with Kevin Kwong and Kathleen Owen

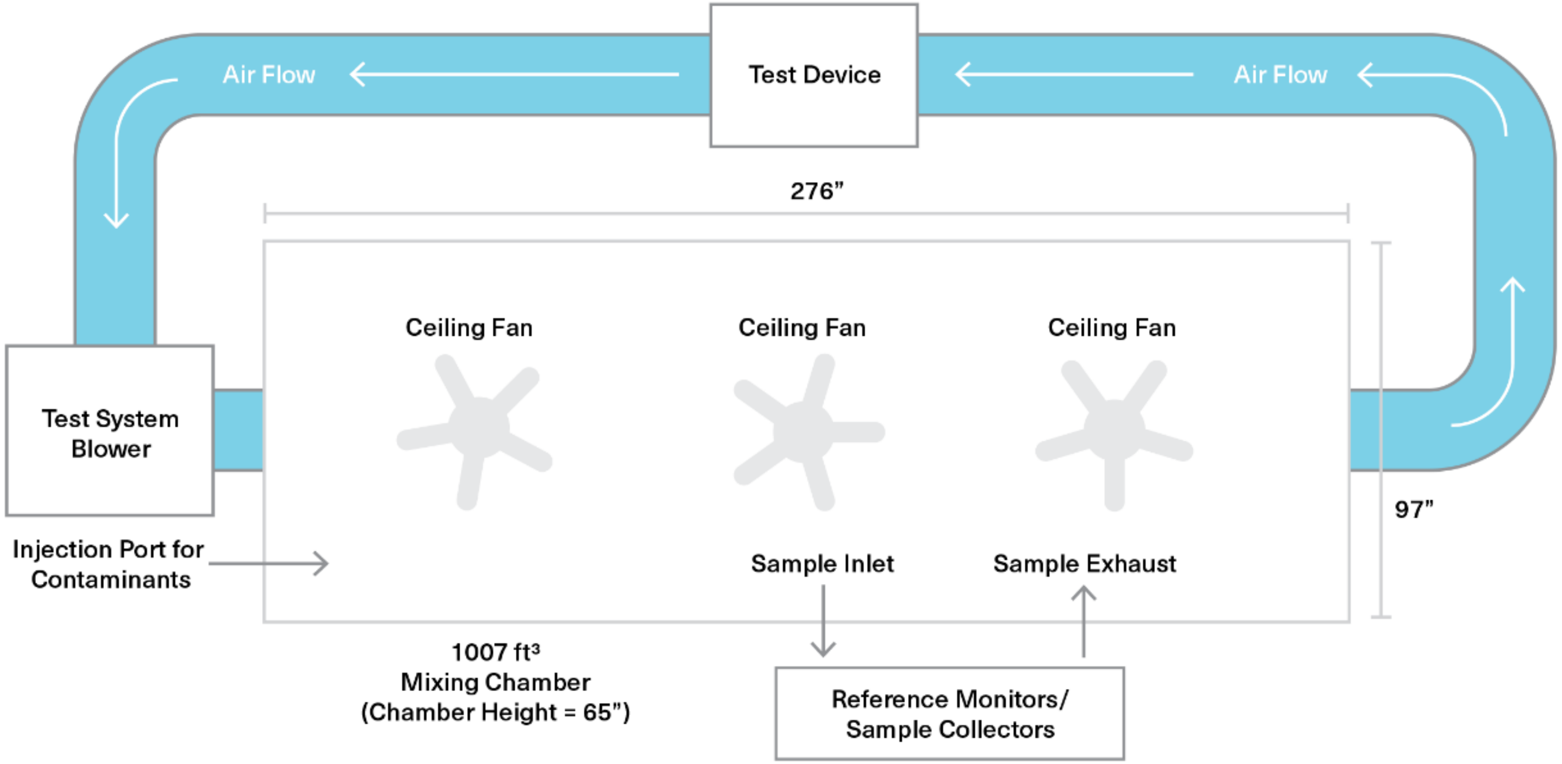
Technologies were examined for two scenarios which define potential customer scenarios

- **In-duct** – In-equipment capability and/or in-duct (BPI, DHP, PCO, UVGI, MERV 13)
- **In-room** – Devices located within the room – standalone (DHP, HEPA)

A consistent testing methodology was used to compare technologies against each other and provide the first industry-wide testing of IAQ cleaning devices

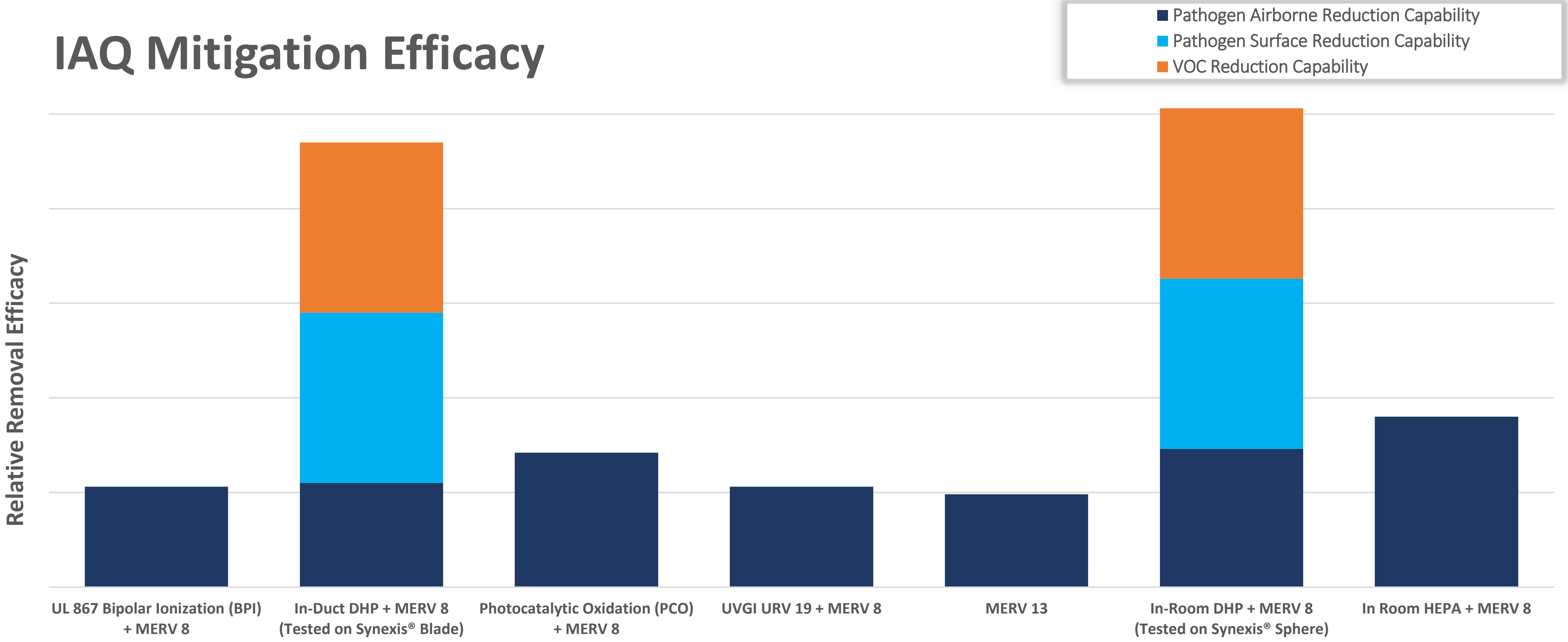
- **Virus reduction capability** – aerosolized and surface test with MS2 virus
- **Bacteria reduction capability** – aerosolized only with Staphylococcus aureus
- **VOC reduction capability** – formaldehyde and toluene
- **Byproduct generation** – ozone, ions, etc.
- **Particle reduction capability** – both small (15-650 nm) and very small (< 100 nm)

Testing Chamber: In-Room and In-Duct



- For both In-Room and In-Duct tests, a nebulizer was used to inject aerosolized MS2 virus into the room
- For In-Room testing, the devices were tested with airflow and without airflow
- For In-Duct testing we conducted testing at 6 ACH and 20 ACH
- For surface pathogen inactivation testing petri dishes were used in the room

IAQ Cleaning Technology Comparison: Airborne & Surface Pathogens, VOCs



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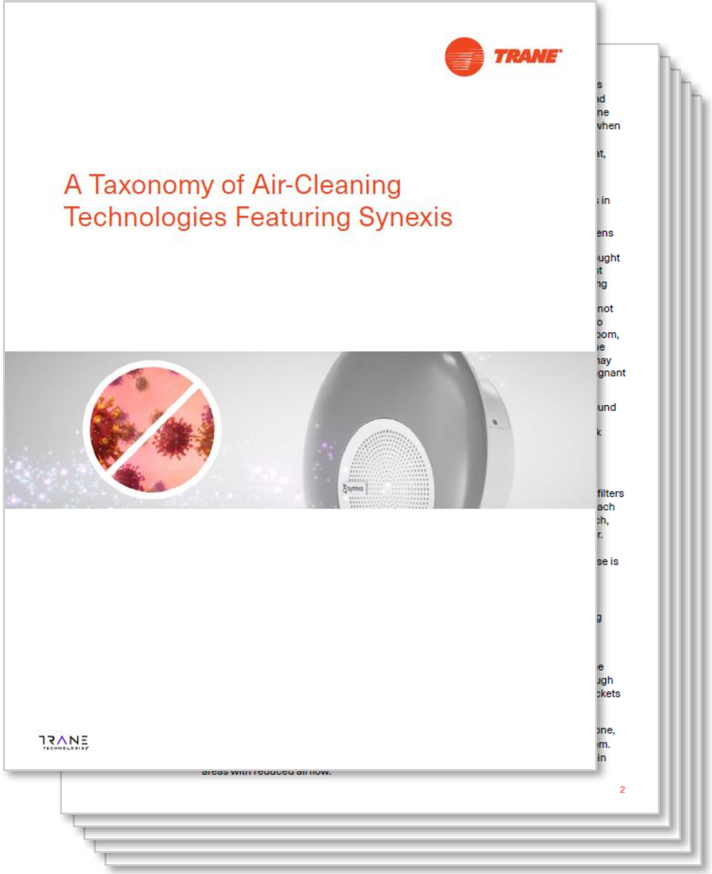
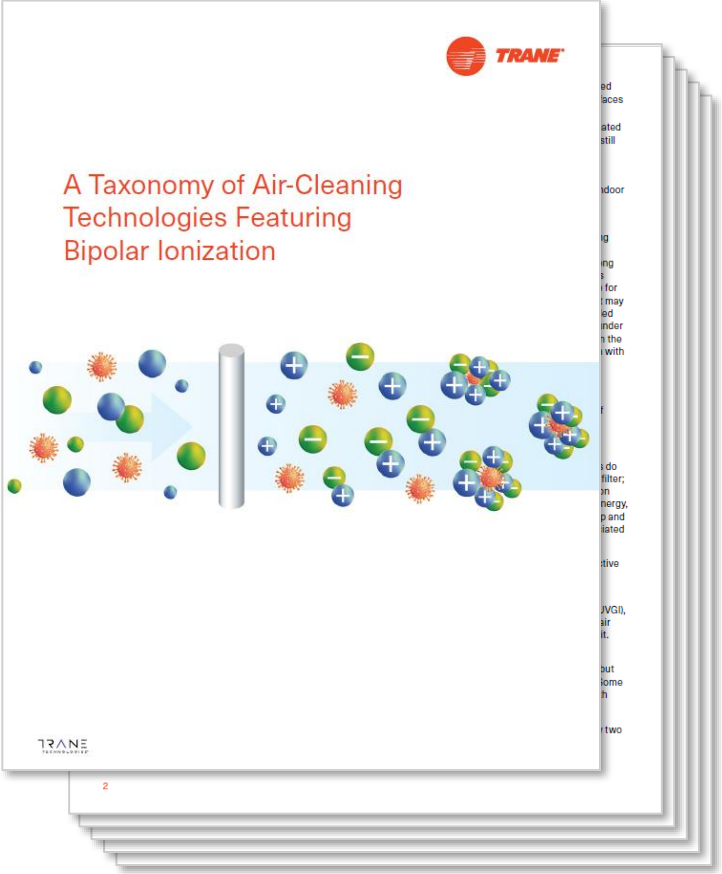
Trane White Papers

Dry Hydrogen Peroxide



https://www.trane.com/content/dam/Trane/Commercial/global/about-us/wellsphere/Cleaning%20Technologies%20Whitepaper%20-%20Synexis.pdf

UL 867 Bipolar Ionization



https://www.trane.com/content/dam/Trane/Commercial/global/about-us/wellsphere/SYS-PRB003-EN_04062022.pdf

Air Cleaning Technologies Performance and Costs

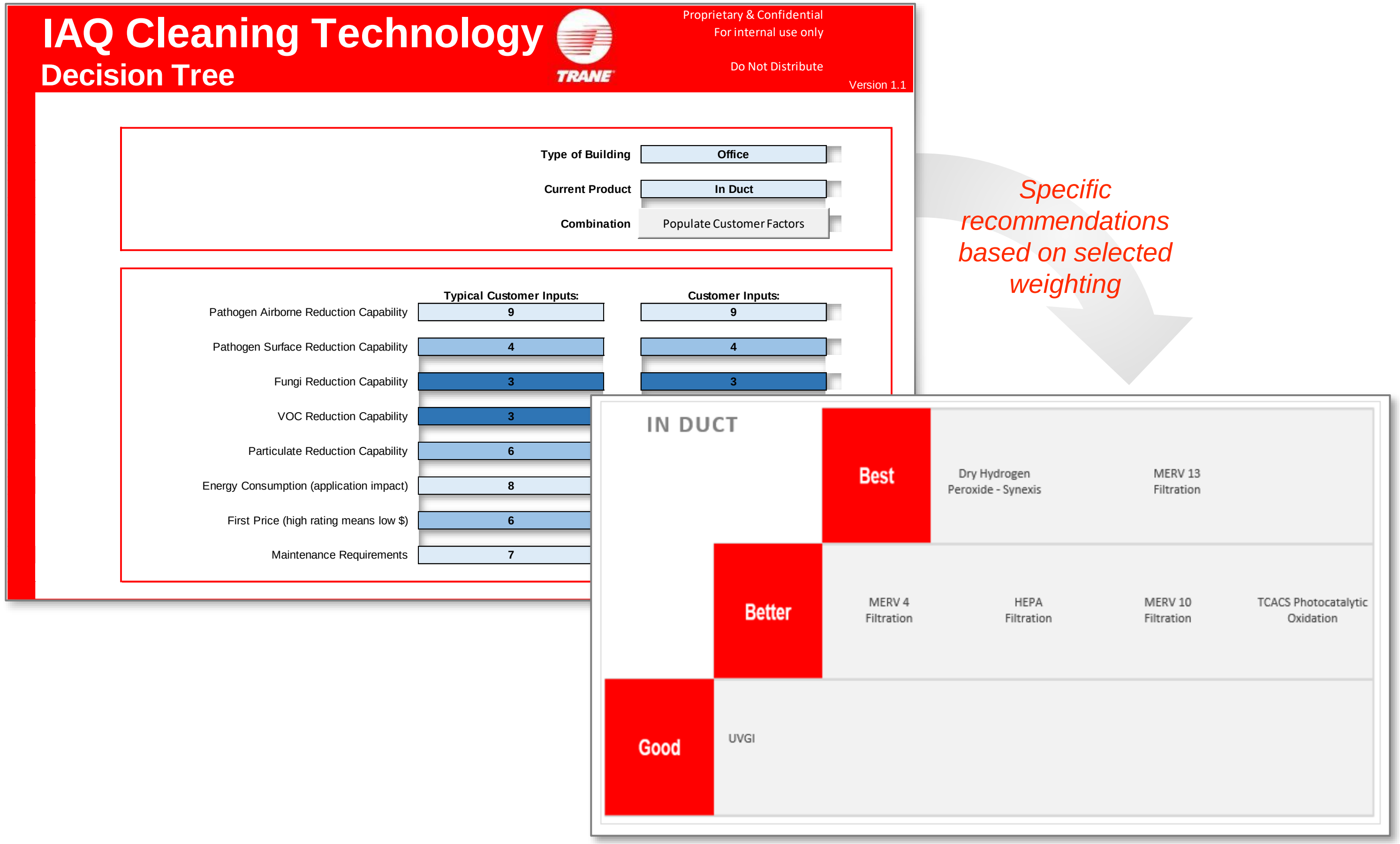
Application	MERV 1-8 Filters	MERV 9-16 Filters	UVGI *(254 nm)*	HEPA Filters	PCO *(TCACS)*	Dry Hydrogen Peroxide *(Synexis®)*
Airborne pathogens (in-duct installation)	🔴	🟡	🟡	🟢	🟢	🟢
Surface pathogens	🔴	🔴	🔴	🔴	🔴	🟢
Fungi	🔴	🟡	🟡	🟢	🟢	🟢
VOCs	🔴	🔴	🔴	🔴	🟡	🟢
Particle reduction	🟡	🟢	🔴	🟢	🟢	🔴
Energy consumption	$	$$	$$	$$	$$	$
First price	$	$	$$$	$$	$$	$$
Maintenance	$	$$	$$$	$$	$	$$

Different IAQ mitigation technologies offer different benefits at different cost points… you must consider performance implications when evaluating costs of different solutions

Selecting the right IAQ technology for your application

Comparing IAQ technologies…
multiple factors need to be considered

- Pathogen Airborne Reduction Capability
- Pathogen Surface Reduction Capability
- Fungi Reduction Capability
- VOC Reduction Capability
- Particulate Reduction Capability
- Energy Consumption (application impact)
- First Price
- Maintenance and Operating Requirements



IAQ Decision Tree can help evaluate different technologies based on selected criteria

Typical IAQ Capabilities for different HVAC system equipment types

	Applied	Light Commercial Unitary	Large Unitary	VRF with DOAS
MERV 8	🟢	🟢	🟢	▲
MERV 13	🟢	▲	🟢	▲
HEPA	🟢	🛑	▲	🛑
UVGI	🟢	▲	▲	▲
Dehumidification Capabilities	🟢	▲	🟢	▲
Humidification Capabilities	🟢	▲	▲	▲
Airside Economizing	🟢	🟢	🟢	🛑
Precision Ventilation	🟢	▲	🟢	▲
Integrated Controls	🟢	▲	🟢	▲

Capabilities vary based on system equipment type

Meeting needs through different technologies

Traditional technologies and methods:

- Ventilation
- Filtration
- UVGI

"Emerging" technologies and methods:

- Dry Hydrogen Peroxide
- Photocatalytic Oxidation
- Ionization

Offers a differentiated value proposition:

- Surface Cleaning
- VOC reduction
- Mold and mildew mitigation

✓ **Renewed focus on balancing efficacy and efficiency**

✓ **Requires a combination of processes, technologies, and products to produce the intended outcome**

Latest EPA, CDC, and ASHRAE® Guidance for Emerging Technologies

Environmental Protection Agency (EPA)

- Manufacturer has data to demonstrate efficacy
- “Do not use ozone generators in occupied spaces”
- Recommends devices that meet UL 2998 standard
  - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners

Air Cleaners. HVAC Filters. and Coronavirus (COVID-19) | US EPA, December 2021

U.S. Centers for Disease Control (CDC)

- “Documented performance data in as-used conditions available from multiple sources. some of which should be independent, third-party sources”
- Minimum of UL 867 (Standard for Electrostatic Air Cleaners)
- Prefers devices that meet UL 2998 standard
  - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners

Ventilation in Buildings | CDC, December 2021

American Society of Heating. Refrigerating and Air-Conditioning Engineers (ASHRAE)

- Only use air cleaners for which evidence of effectiveness and safety is clear
- Seek testing data that shows efficiency and occupant safety under conditions consistent with the intended use before selecting these air cleaners
- ASHRAE 62.1-2019 requires electronic air cleaners meet UL 2998 standard

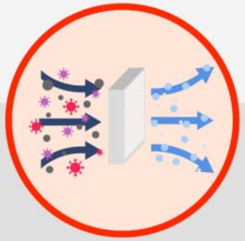
*ashrae-filtration_disinfection-c19-guidance.pdf, December 2021

Trane Commercial portfolio aligns with CDC, ASHRAE and EPA recommendations* for indoor air quality mitigation technologies

TRANE

These organizations specifically recommend*:

MERV13 or higher filtration for HVAC systems



HEPA filters for in-room filtration devices

UVGI lights sized properly for "on the fly" deactivation of pathogens

Electronic air cleaners that meet "emerging technology" recommendations / requirements

When it comes to emerging technologies, both CDC and ASHRAE recommend:

Equipment meets UL 2998 standard certification (zero ozone emissions)

Testing for efficacy, efficiency, and occupant safety in "conditions consistent with intended use"

Independent, 3rd party testing data to substantiate claims for:

- Airborne efficacy
- Surface efficacy (if manufacturer claims surface disinfection)
- VOC reduction (if manufacturer makes claims)

*Coronavirus references, as of Dec. 14, 2021:
EPA: https://www.epa.gov/coronavirus/air-cleaners-hvac-filters-and-coronavirus-covid-19
CDC: https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html
ASHRAE: https://www.ashrae.org/file library/technical resources/covid-19/ashrae-filtration_disinfection-c19-guidance.pdf

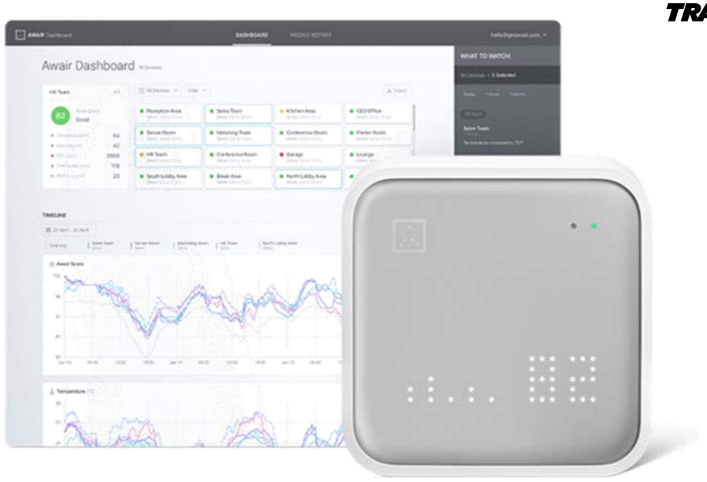
Evolution of Building Automation Systems and IAQ Monitoring

Traditional comfort space sensing technologies do not tell the whole story.

Traditional HVAC demand-controlled ventilation sequences are designed to minimize ventilation (dilution) based on carbon dioxide.

We Can’t Manage What We Aren’t Measuring

You Can’t Manage What You Can’t Measure



Traditional Focus

Temperature

Humidity

CO_2

Efficiency

Growing Needs

Volatile Organic Compounds (VOCs)

Fine Dust (PM 2.5)

Ambient Light (Lux)

Ambient Noise (dBA)

Advanced sensing solutions are required to better manage and validate IAQ

Increasing focus on IAQ monitoring

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EPA – Clean Air in Buildings Challenge… March 2022

1. **CREATE AN ACTION PLAN FOR CLEAN INDOOR AIR IN YOUR BUILDING(S)** that assesses IAQ, plans for upgrades and improvements, and includes HVAC inspections and maintenance.

- Determine how clean outdoor air is brought into the building and distributed to all occupied spaces. Understand and document how HVAC systems work for your building.
- Work with an HVAC expert to assess and inspect systems for ventilation, filtration, and air cleaning. Verify through commissioning, testing, and balancing that building systems are functioning as designed.
- Implement other IAQ assessment approaches such as carbon dioxide (CO_2) monitors as needed.
- Determine how much clean air (outdoor air + filtered HVAC recirculation air) is needed and verify or measure air delivery for each room or space.
- Assess if you need to manage the direction of a… office).
- Create an IAQ action plan that includes regula… HVAC system upgrades or improvements, as n…
- Support the people who operate or help with b… continuing education and training.

4. **GET YOUR COMMUNITY ENGAGED IN YOUR ACTION PLAN** by communicating with building occupants to increase awareness, commitment, and participation in improving indoor air quality and health outcomes.

- Communicate to affected people (e.g., building occupants, workers, students, teachers, and parents) about how the action steps you are taking will improve indoor air quality and reduce disease transmission in your building.
- Show your work by hosting building walkthroughs, posting descriptive signage, or communicating on social media. Demonstrate the importance of individual actions to ensure facility operations are optimal (e.g., keeping ventilation systems clear of clutter).
- Provide feedback mechanisms such as maintenance requests to identify repair issues and surveys to gather perspectives from your community.
- Remember individual actions and layered prevention strategies remain important measures for reducing the spread of viruses like COVID-19.

https://www.epa.gov/system/files/documents/2022-03/508-cleanairbuildings_factsheet_v5_508.pdf

National COVID-10 Preparedness Plan – White House, March 2022

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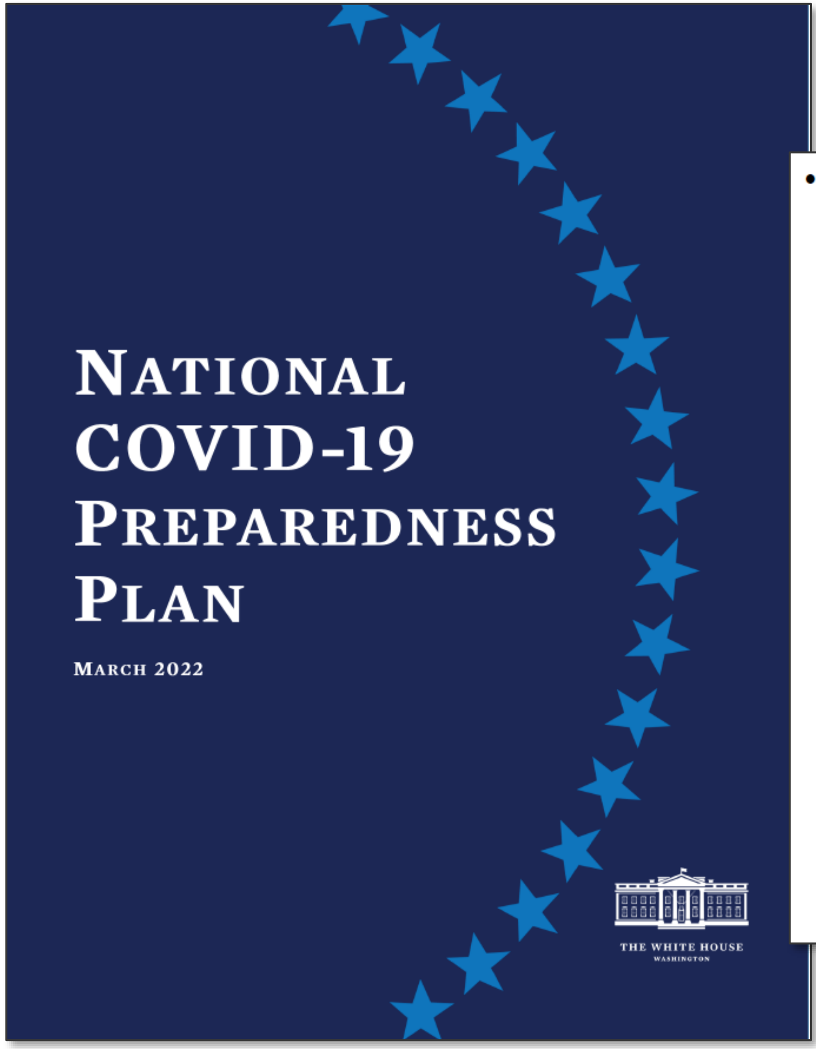


https://www.whitehouse.gov/covidplan/

- Highlight actions taken by buildings to achieve clean, healthy air quality through a recognition program. While the Administration invites all buildings to take actions from the Clean Air in Buildings Checklist, the Administration will also foster ways to recognize steps taken by buildings to improve indoor air quality and protect their communities. The CDC, EPA, DOE, and other federal agencies already provide significant support to advance strong ventilation in buildings – including through funding, technical assistance, and other resources. Building on the expertise of federal government experts, the Administration will also engage industry, scientific, academic, and labor leaders to identify ways to recognize the efforts of buildings and leaders across sectors and around the country to achieve high standards in ventilation and indoor air quality, as well as improvements in ventilation systems from their current levels. The Administration will use this opportunity to encourage further uptake of ventilation improvements and step up efforts to recognize accomplishments in the indoor air quality space. Similar to how programs like LEED, Fitwel, and WELL recognize buildings for their environmental and health impacts, this new effort between the federal government and external experts will develop ways to recognize steps taken by building owners for the health and safety of their communities and their achievements in improving air filtration and ventilation systems to protect and promote public health.

International Well Building Institute™ – WELL V2

TRANE

WELL v2, Q1 2022

Imperial 中文 Sign

Air

Overview

- P A01 Air Quality
- P A02 Smoke-Free Environment
- P A03 Ventilation Design
- P A04 Construction Pollution Management
- 4 Pts A05 Enhanced Air Quality
- 3 Pts A06 Enhanced Ventilation Design
- 2 Pts A07 Operable Windows
- 2 Pts A08 Air Quality Monitoring and Awareness
  - Part 1: Install Indoor Air Monitors
  - Part 2: Promote Air Quality Awareness
- 2 Pts A09 Pollution Infiltration Management
- 1 Pt A10 Combustion Minimization
- 1 Pt A11 Source Separation
- 1 Pt A12 Air Filtration
- 1 Pt A13 Enhanced Supply Air
- 1 Pt A14 Microbe and Mold Control

This WELL feature requires the ongoing measurement of contaminant data to educate and empower occupants about their environmental quality.

Read more

REQUIREMENTS — WELL Core — Collapse All

Part 1

Install Indoor Air Monitors (1 Point)

For All Spaces Except Dwelling Units | For Dwelling Units

Meet the following:

1: Sensor requirements

The project deploys monitors that measure at least three of the following parameters, in compliance with the requirements outlined in the Continuous Monitoring Protocols of the Performance Verification Guidebook:

a. $PM_{2.5}$ or PM_{10}.
b. Carbon dioxide.
c. Carbon monoxide.
d. Ozone.
e. Nitrogen dioxide.
f. Total VOCs.
g. Formaldehyde.

Verified by On-site Photographs , Letter o

https://v2.wellcertified.com/en/wellv2/air/feature/8

Part 2

Promote Air Quality Awareness (1 Point)

For All Spaces except Dwelling Units

Note:
Projects may only receive points for this part, if Part 1 is also achieved

Information about the air quality measured in Part 1 of this feature is made available to occupants as follows:

a. Data are presented through one of the following:

1. Display screens prominently positioned at a height of 3.6–5.6 ft with at least one display per 5400 ft² of regularly occupied space.
2. Hosted on a website or phone application accessible to occupants. Signs are present indicating where the data may be accessed at a density of at least one sign per 5400 ft² of regularly occupied space.

b. Data presented include one of the following:

1. Concentrations of the parameters measured.
2. Qualitative results of air quality (e.g., colored-coded levels).

Many IAQ Monitoring devices can be integrated into BAS systems

Trane CO_2 Air-fi® Sensor

AirThings™

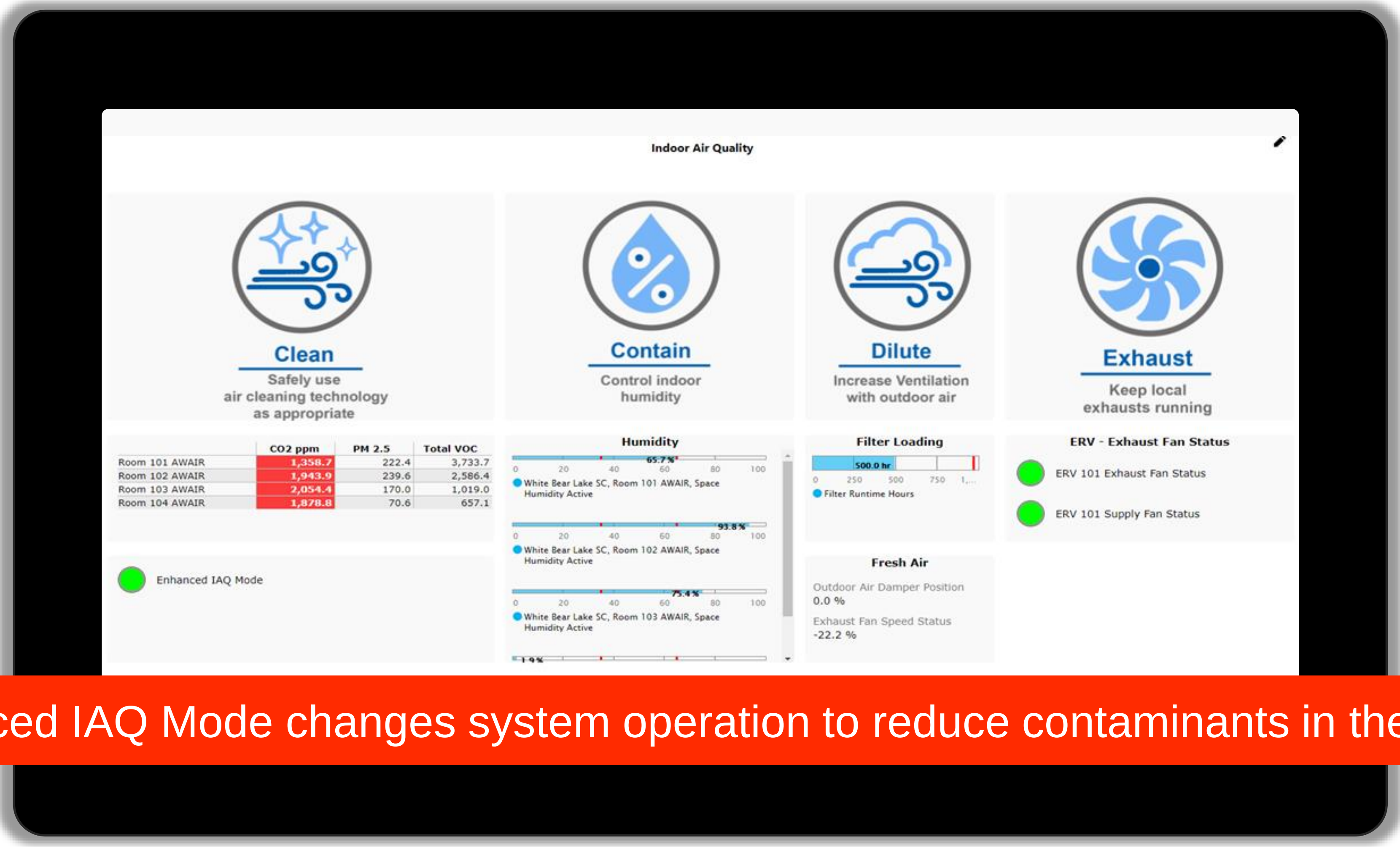
https://www.airthings.com/business

Awair™

https://www.getawair.com/products/omni

- In-room measurement of air quality parameters *(T, RH, CO_2, tVOCs, PM, etc.)*
- Wired or wireless installations available
- Real-time sensor readings
- Integration into existing BAS/BMS systems via BACnet, MSTP or APIs

Using Flexible Automation Systems to Manage for Variable Conditions



Enhanced IAQ Mode changes system operation to reduce contaminants in the space

FINAL TAKEAWAYS

Buildings are increasingly dynamic spaces

There is a long-term need to balance high-quality indoor environments with energy efficiency

Technology will continue to advance and accelerate to enable healthier, more efficient spaces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