

**THE EVER EVOLVING
LANDSCAPE OF IAQ
MONITORING DEVICES with
JOE MEDOSCH of HAYWARD
HEALTHY HOMES**

Peter Troast, Founder & CEO
Energy Circle Webinar Series
October 27, 2021



<https://share.getawair.com/view?url=dF11v2PGg&tempUnit=F>





THE CURRENT LANDSCAPE



TP Today's Parent

I can't believe back-to-school is even scarier and more stressful than last year

While the province has ignored expert medical recommendations like smaller class sizes and made minimal efforts to improve ventilation in ...

1 day ago



KitchenerToday.com

Public school board working on ventilation in schools, more measures ahead of new school year

30 per cent of our schools are partially supported through mechanical ventilation, and a tiny portion is not," said Gerard. The board estimates ...

5 days ago

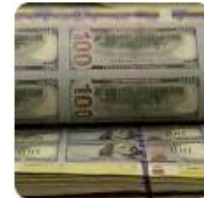


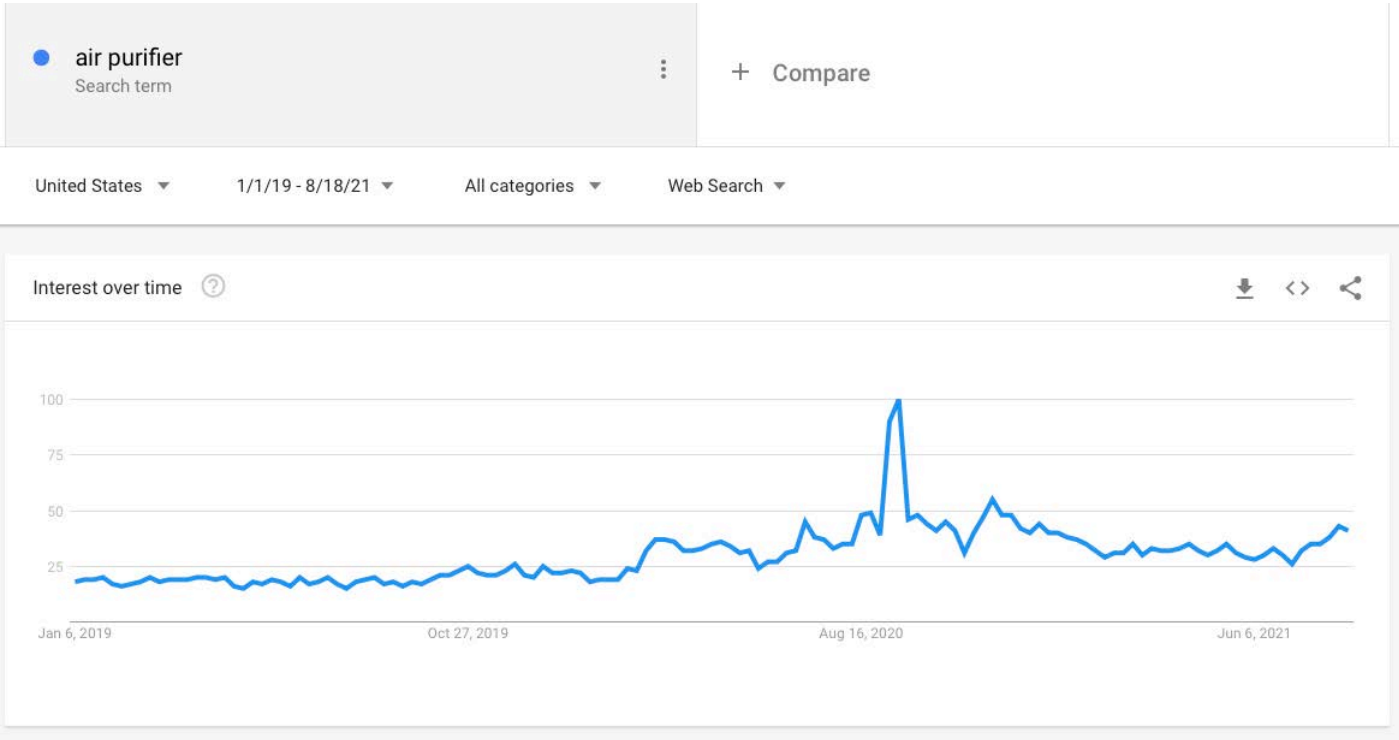
WLSL

Millions of dollars being used for upgrades at schools across the region

PITTSYLVANIA COUNTY, VA – Millions of dollars in COVID-19 relief money are going to local schools. Replacing heating, ventilation and air ...

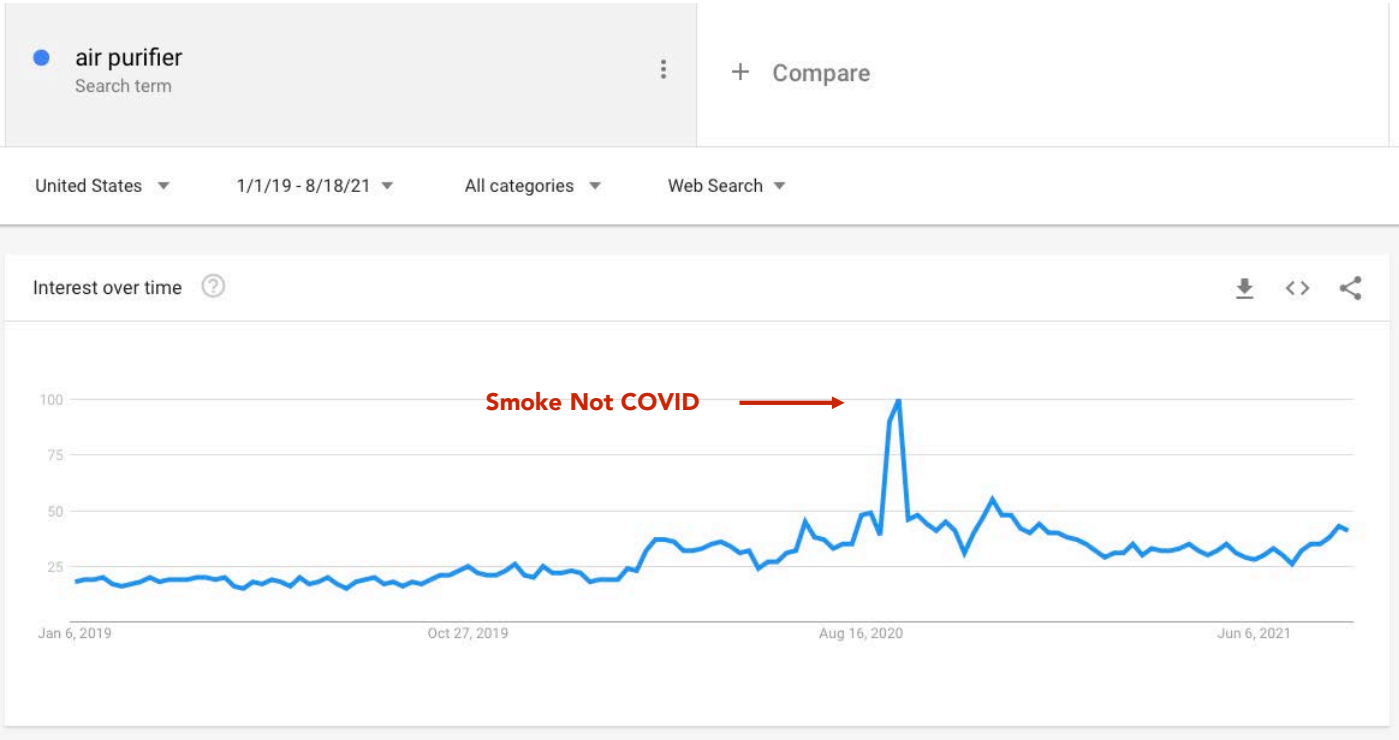
6 days ago





Google Trends, 1/1/20 to present
Taken August 18, 2021



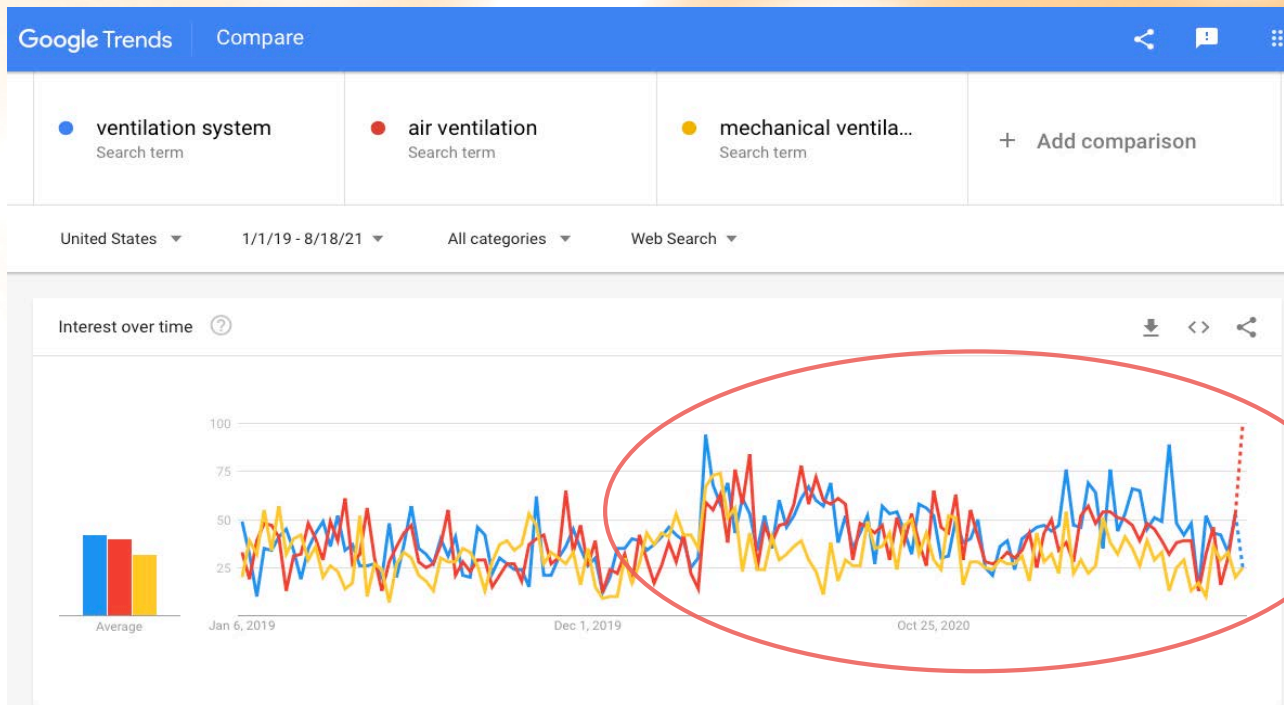


Google Trends, 1/1/20 to present
Taken August 18, 2021

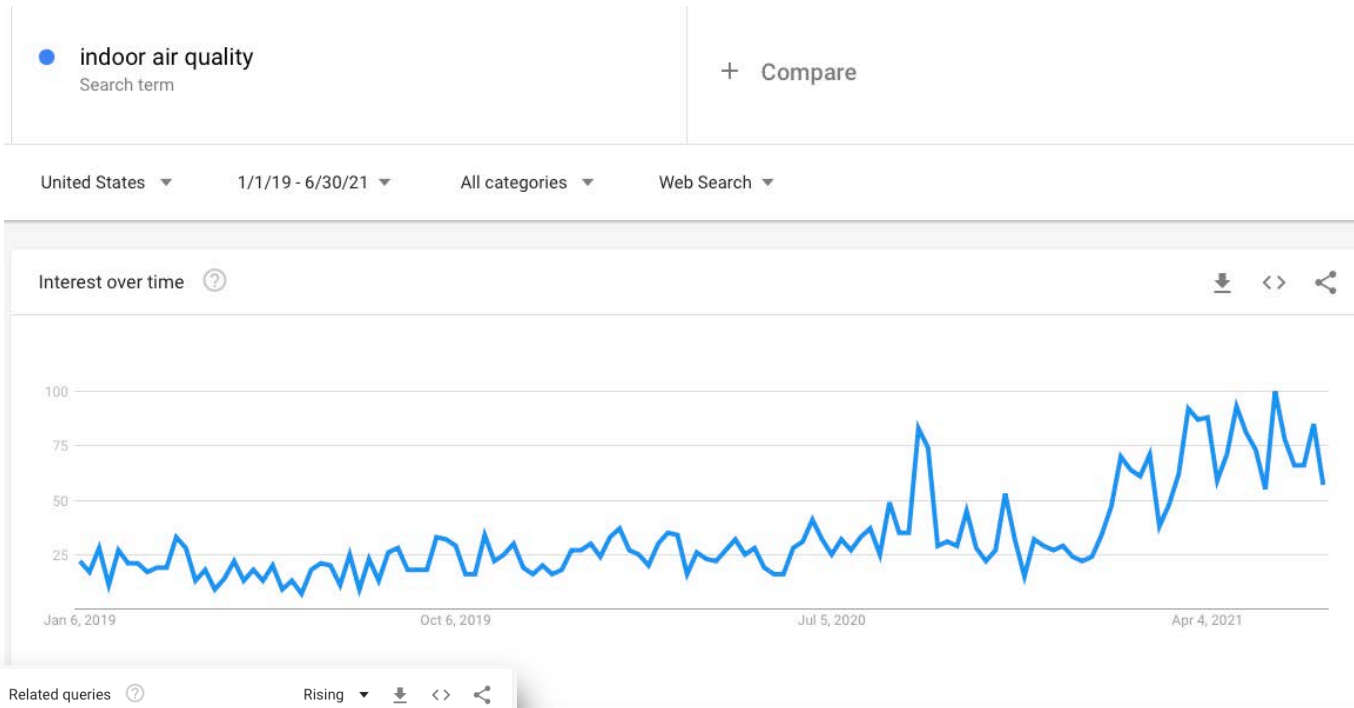




The COVID Bump for Ventilation



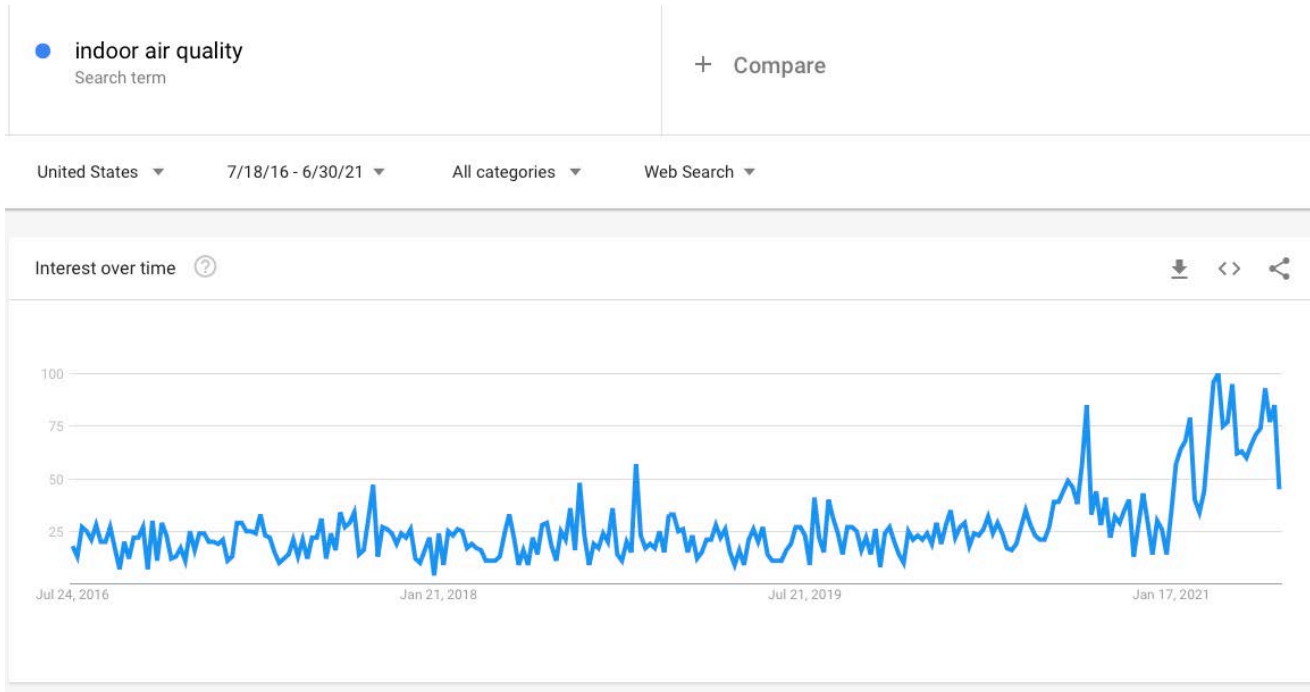
Google Trends, 1/1/19 to present
Taken August 18, 2021



Related queries ? Rising ▾

1	how to test indoor air quality	+400%
2	indoor air quality testing companies near me	+250%
3	indoor air quality testing near me	+110%
4	indoor air quality solutions	+110%
5	air quality monitor	+90%

Google Trends, Jan 2019 to present
Taken Aug 18, 2021



Google Trends, Past 5 Years
Taken August 18, 2021

Device Industry Trends

- Low Cost Consumer Devices Weren't Successful (Foobot)
- Some Manufacturers Have Pivoted to Commercial (AirThinx)
- Shift is to Active (System Connected) vs Passive Monitoring
- Sensors are Increasingly Everywhere and In Everything
- Few Device Makers Have Cracked the Auto Generated Report (only Air Advice)
- Chips/Supply Chain Impacting Prices
- Simplified Connectivity—Bluetooth/WIFI/Zigbee/4G & 5G
- Commercial Demand is Hot, Many Manufacturers Shifting Focus
- Wildfire Smoke a Significant Driver





THE LATEST ON DEVICES



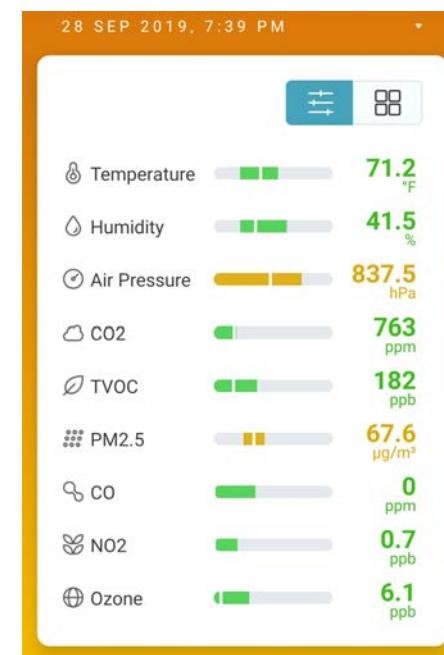
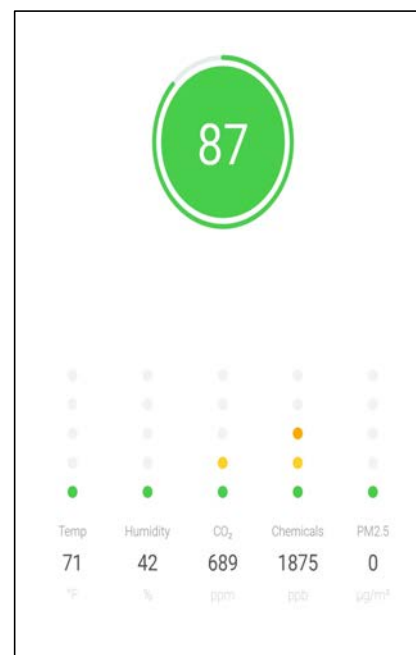
Still Trend Indicators

IAQ Monitors have limited accuracy

Not a Blood Test

Blood Test	Result	Normal Value
WBCs (billion/L)	8.00	3.5 to 10.5
Neutrophils (%)	62	40 to 70
Lymphocytes (%)	28	25 to 45
Monocytes (%)	10	2 to 8
Eosinophils (%)	1	1 to 5
Basophils (%)	0	0 to 1
RBCs (trillion/L)	3.84	4.3 to 5.7
Hb (g/dL)	11.7	13 to 17
Hematocrit (%)	37	37 to 52
Platelets (billion/L)	262	150 to 450

IAQ Monitor Results



ASTM D8405-21 Sensor / Sensor Systems Test Method

1.1 This test method uses a chamber system to evaluate the performance of stationary PM_{2.5} sensors (sensors) and particle sensor systems (sensor systems) subjected to various test conditions, including temperature, relative humidity, PM_{2.5} concentration, and coarse PM interferent concentration.

1.1.1 This test method covers sensors and sensor systems that can be continuously powered and continuously operated for the duration of any test described in this method through line power or an internal battery of sufficient output. This test method is not meant to evaluate sensors or sensor systems without these capabilities.

1.1.2 This test method evaluates the performance of sensors and sensor systems that allow users to collect data in a systemic manner to assess the capabilities and limitations of these devices.

1.1.3 This test method is not meant to evaluate sensors or sensor systems without data storage and recording capabilities.

1.1.4 This test method is not intended to evaluate indoor air quality sensors and sensor systems for purposes of regulation of outdoor air, homeland security, law enforcement or forensic activity.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.3 The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

ASTM INTERNATIONAL



ASTM D8405-21 Sensor / Sensor Systems Test Method

Uses a robust chamber test

- Sensors and sensor systems are exposed to PM2.5 under a variety of conditions and their readings are compared to an FEM (federal equivalent method) reference monitor that has itself been subjected to rigorous testing.
- The test determines sensors (and systems) react to different concentration levels. Including variations in temperature and relative humidity, and exposure to interferent particles
- Includes testing with accelerated aging.

Devices	Sensors	Unique Specs	Dashboard	Price
Awair Element	CO2, PM2.5, VOC's, Temp, Humidity	30 day download	No	\$299
Awair Omni	CO2, PM2.5, VOC's, Temp, Humidity, Light, Noise	Battery	Yes	\$399 + \$60/year
Haven	PM2.5, VOC's, Temp, Humidity		Yes	\$800
AirThings	CO2, PM2.5, VOC's, Temp, Humidity, BP, Radon	Battery	Yes	\$299
iQi	CO2, PM2.5, VOC's, Temp, Humidity, Dewpoint		Yes	?
IQAir Visual PRO	CO2, PM2.5, Temp, Humidity, Local AQI	Battery	No	\$295
uHoo	CO2, PM2.5, VOC's, Temp, Humidity, CO, NO2, Ozone, BP		No	\$330 + \$99
Air Advice	CO2, PM2.5, VOC's, Temp, Humidity	Automated Report, Battery	Yes	~\$2490 Yr 1, \$995 Yr 2
Senseware	Customizable	5G, 5G, Multi-room, Commercial & Schools	Yes	Variable, but High
Ventacity IAQPro	CO2, PM2.5, VOC's, Temp, Humidity	5G, Multi-room, Commercial & Schools	Yes	TBD



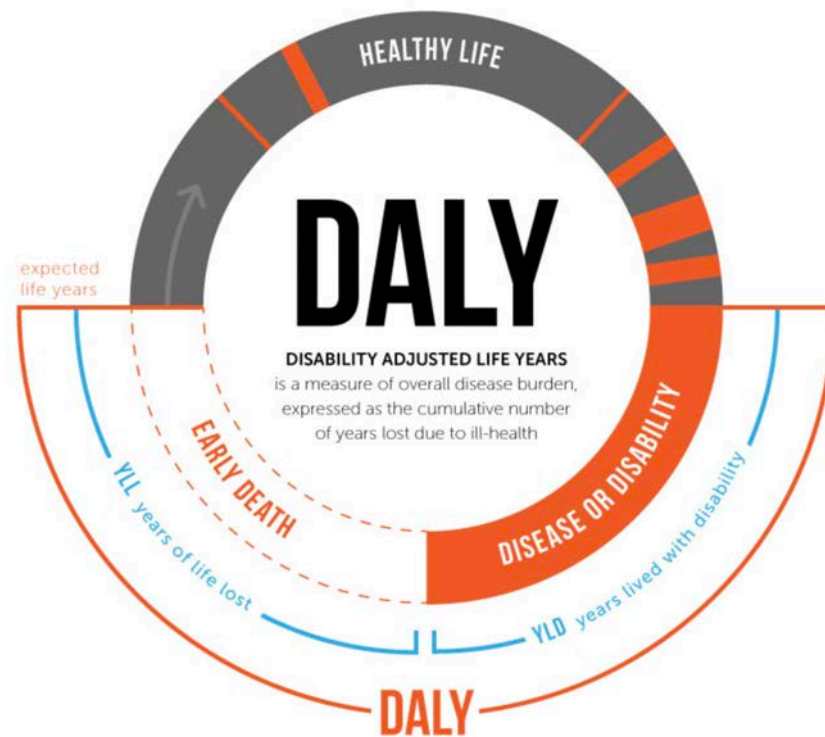
ASTM D8405-21 Sensor / Sensor Systems Test Method

Want to learn more or be considered to be on the certification development committee, contact...

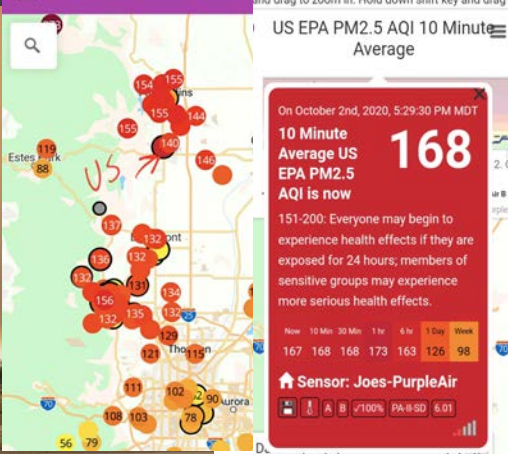
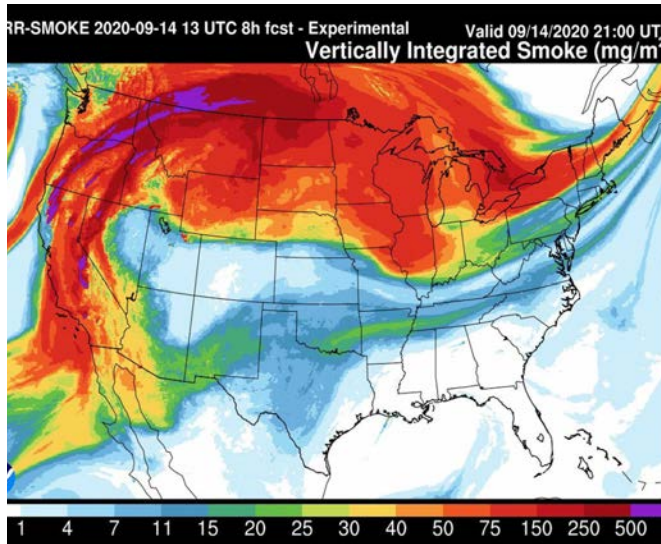
Matt Matheny - Engineering Director iaq@hvi.org

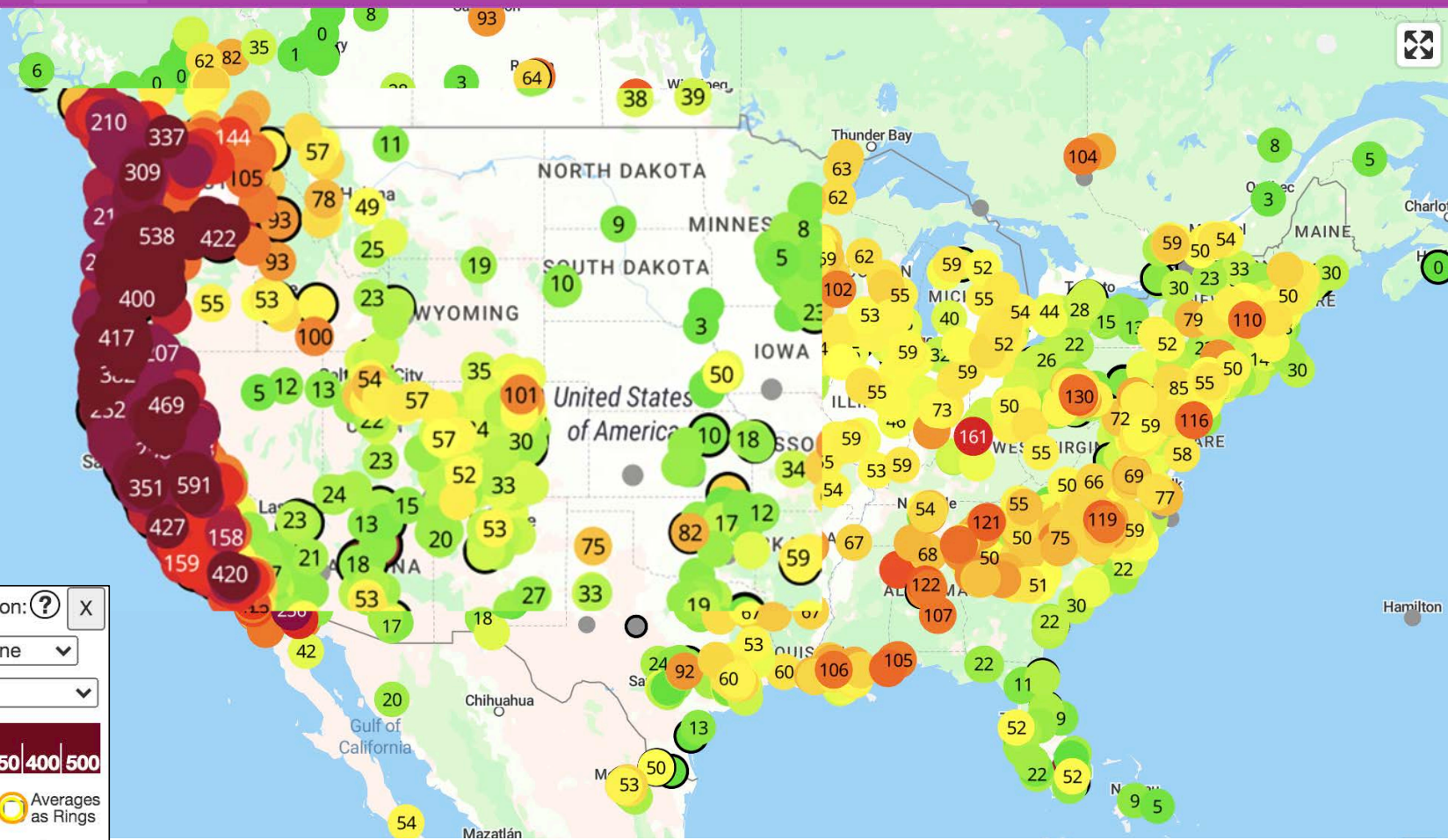


Which Indoor Air Pollutant is most responsible for lost Disability-Adjusted Life Years (DALYs)?



PM2.5





Map Data Layer: ? Conversion: ? X

US EPA PM2.5 AQI None

Standard 10 Minute Average

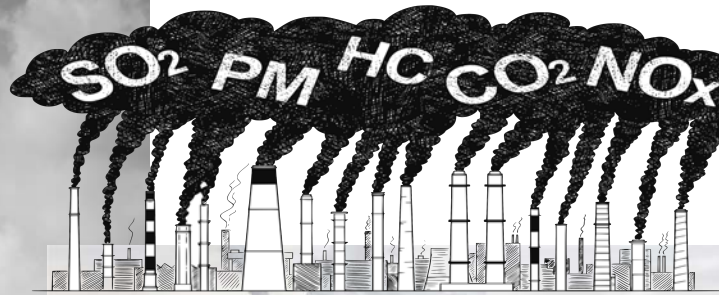
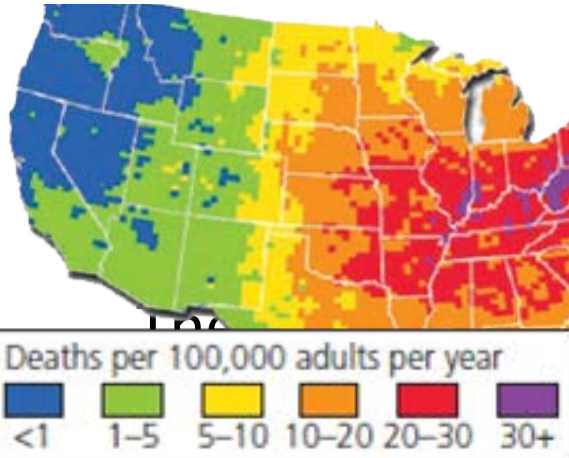
n/a 0 50 100 150 200 250 300 350 400 500

Outside Sensors Inside Sensors Show My Sensors Averages as Rings

November 5th, 2020, 2:49:13 AM MST

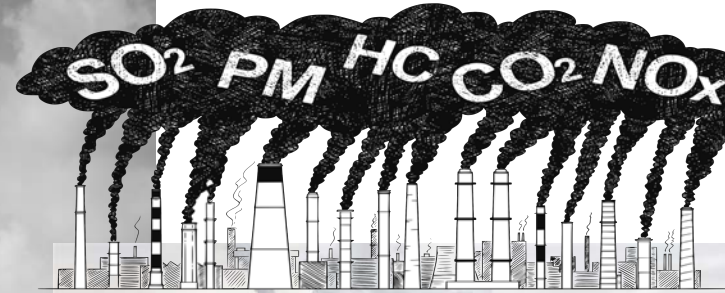
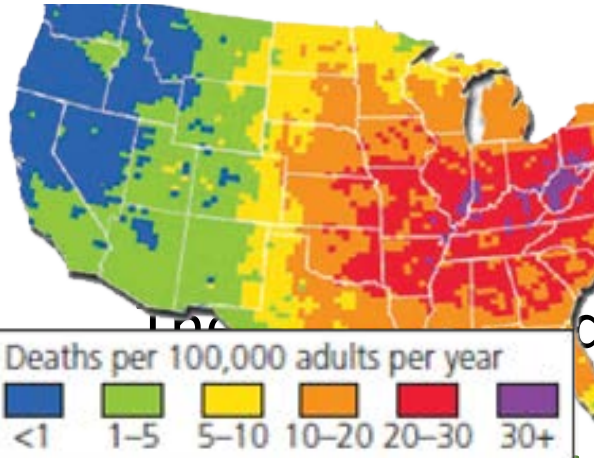
<https://www.purpleair.com/map?opt=1/mAQI/a10/cC0#3.37/34.08/-100.5>





**AIR QUALITY
ADVISORY.
AVOID IDLING.**





AIR QUALITY
ADVISORY.
AVOID IDLING.

An estimated **~130,000 Deaths** in 2005 in
The US due to **Outdoor PM_{2.5}**
Most of this exposure occurs Indoors

<https://www.built-envi.com/wp-content/uploads/stephens-UIUC-talk-indoor-exposures-to-outdoor-pollutants-feb-16-2017.pdf>



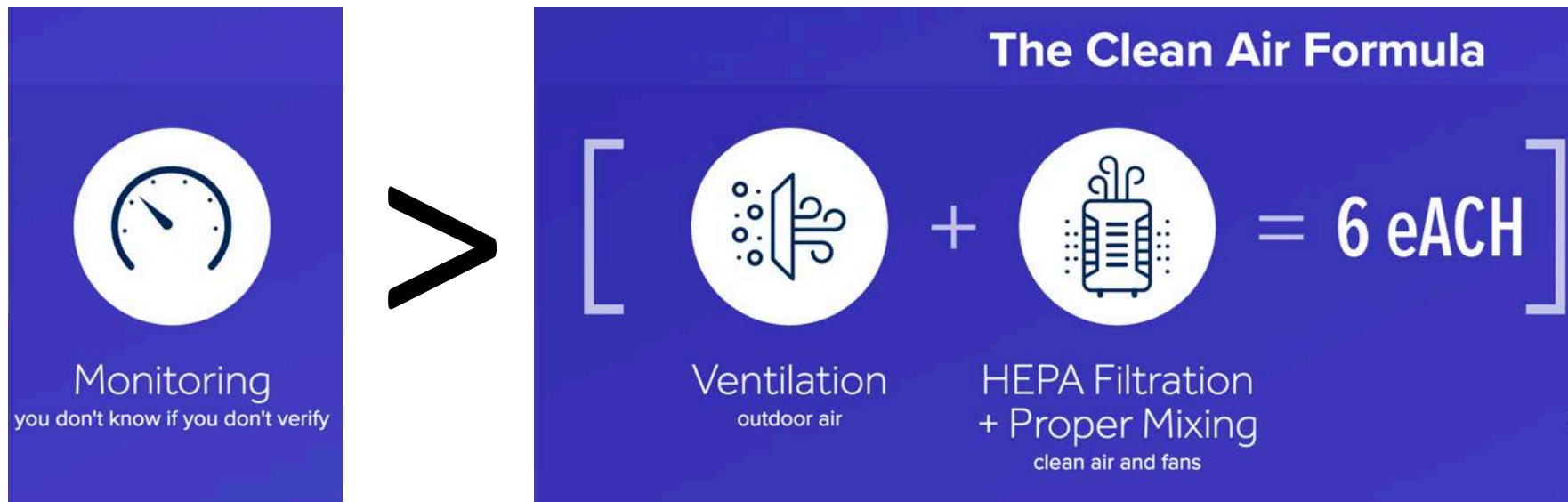
PM2.5 and CO₂

Brett Singer (LBL Labs) says...

“Most monitors that have PM2.5 and CO₂ sensors are basically accurately enough to provide you with actionable information on the house.”

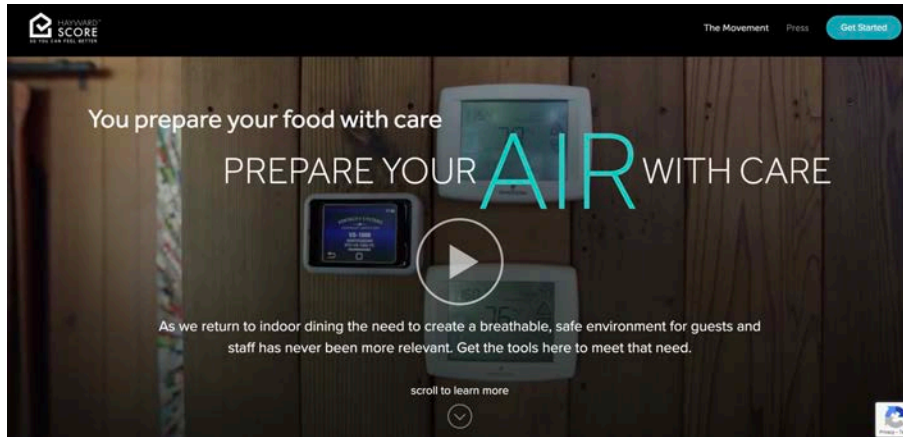


Opportunities



Restaurants

The Washington Post



cleanrestaurantair.com



<https://www.washingtonpost.com/health/interactive/2021/indoor-air-quality-safety-experiment/>



Schools

HAYWARD SCORE
BE THE CLEAN FEEL BETTER

The Movement Press Watch The Video Series

Return to school the right way, return to school with
CLEAN CLASSROOM AIR

SCHOOL BUS

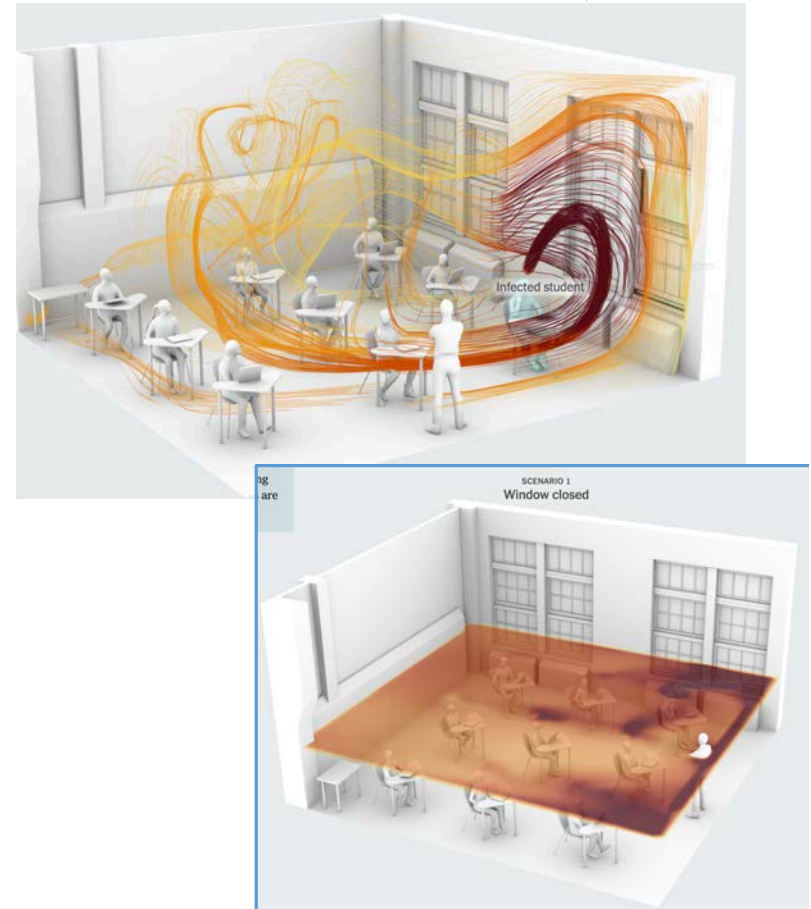
Learn how to reduce the risk of airborne infections in the classroom to be equal or better than being outdoors. By monitoring and then improving your classroom's air quality, you reduce risk and improve educational outcomes.

scroll to learn more

cleanclassroomair.com



The Washington Post

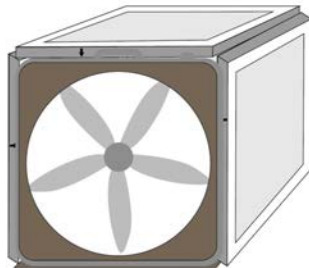
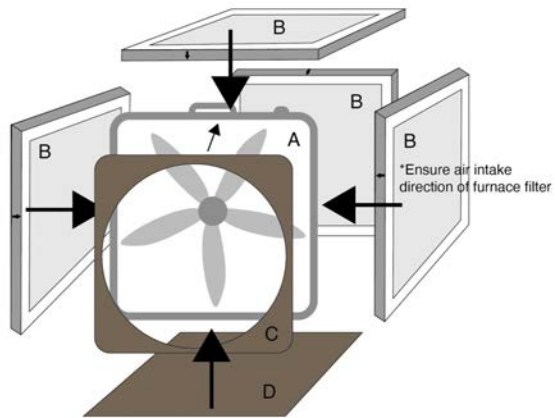


<https://www.nytimes.com/interactive/2021/02/26/science/reopen-schools-safety-ventilation.html>

Schools

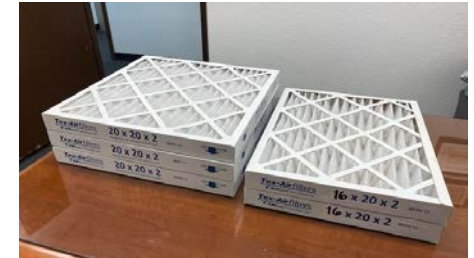
Corsi-Rosenthal Box

illustrated by @ughbeta



- Materials:
- (A) 1x 20"x20" box fan
 - (B) 4x 20"x20"x1" furnace filters
MERV 13*/Filtrete FPR 1900
(*can use MERV 11 if not available)
 - (C) 1 fan shroud made of fan box
 - (D) 1 fan bottom made of fan box
- lots of duct tape to seal everything super well

References:
 Twitter: @corsIAQ, @jimrosenthal4, @kprather88
<https://www.texairfilters.com/a-variation-on-the-box-fan-with-merv-13-filter-air-cleaner/>
<https://www.texairfilters.com/how-to-improve-the-efficiency-of-the-box-fan-and-merv-13-filter-air-cleaner/>



Passive vs. Active Monitors

You Can Only Control
If You Measure the Conditions.

If you Measure the Conditions...
Can You Control the Conditions

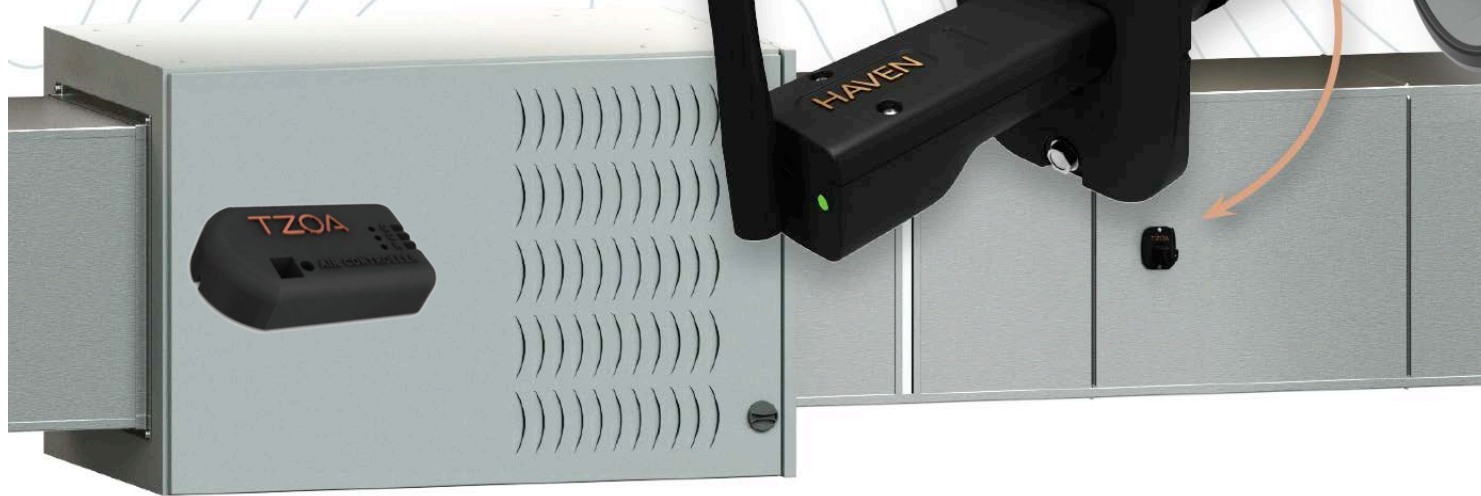
Honorable Mention

HAVEN™

Central Air Monitor

by TZOA®

In-duct monitor integrates with any HVAC system to track indoor air quality



CENTRAL AIR CONTROLLER

To control HVAC system fan during air quality events and ensure regular circulation

OTHER EQUIPMENT

Automatically triggers ventilation or filtration during AQ events



AH Control



Indoor Stand Alone Device

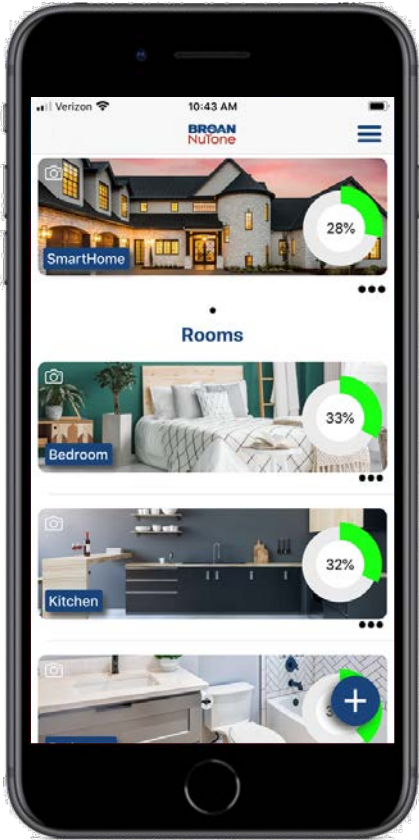


HAYWARD
SCORE

Sensor Integration CONNECTED IAQ SYSTEM

BROAN

NuTone



Temp
RH
tVOC



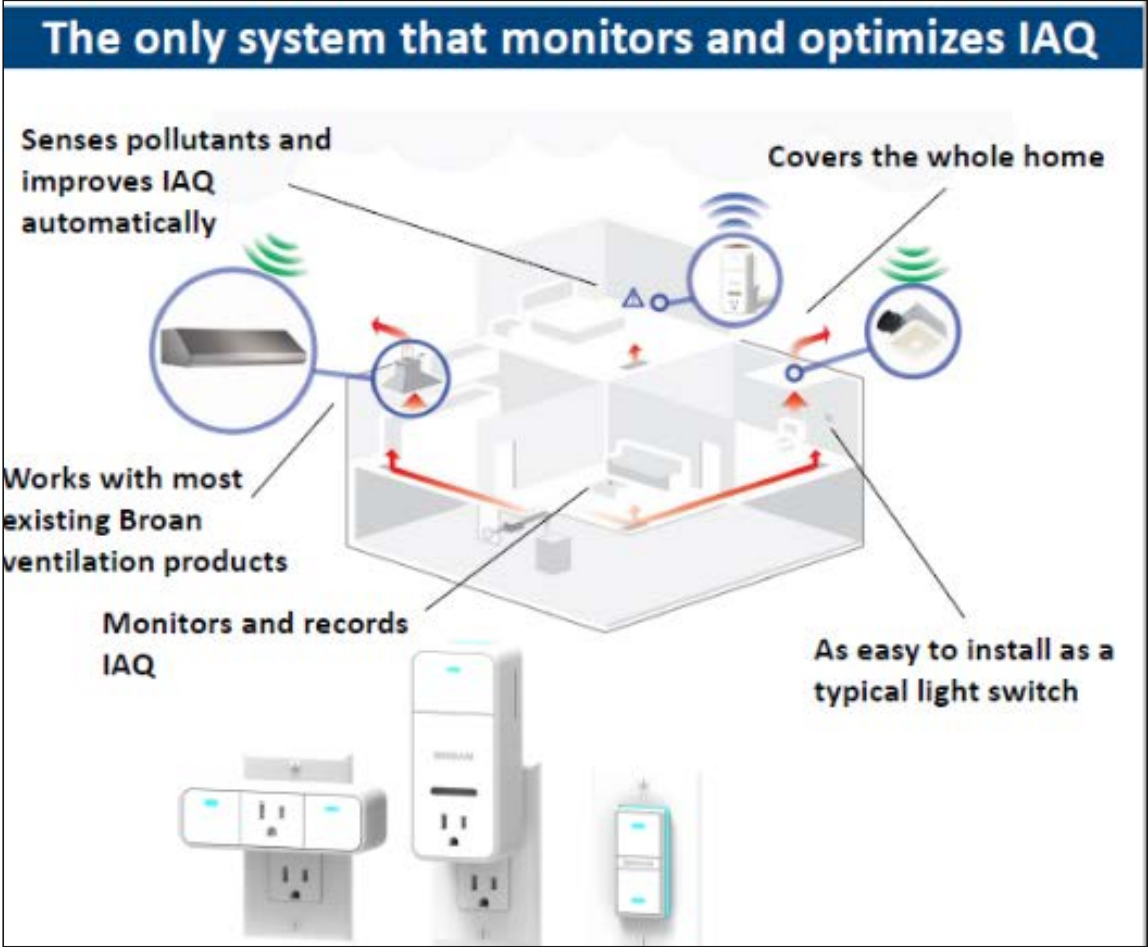
Temp
RH
tVOC
PM 2.5



Sensor Integration

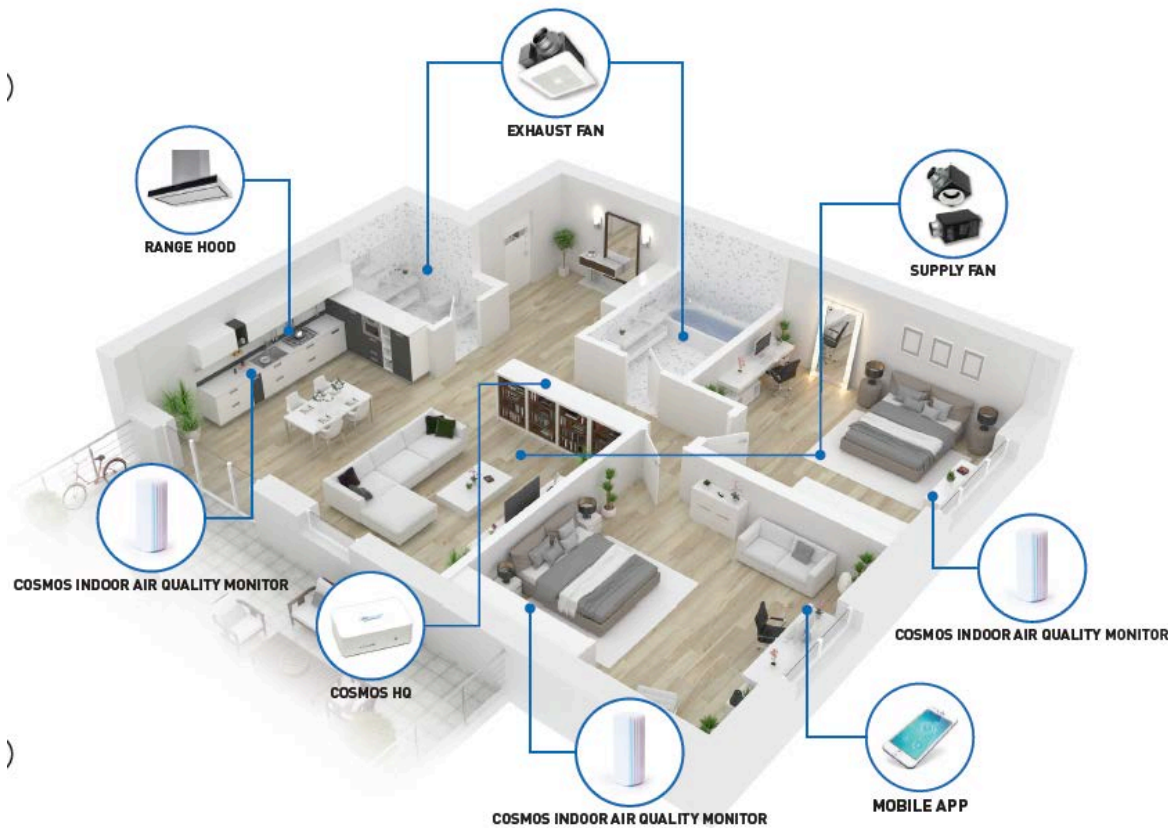
BROAN[®]

NuTone[®]



Sensor Integration

Panasonic



Cosmos Command Center



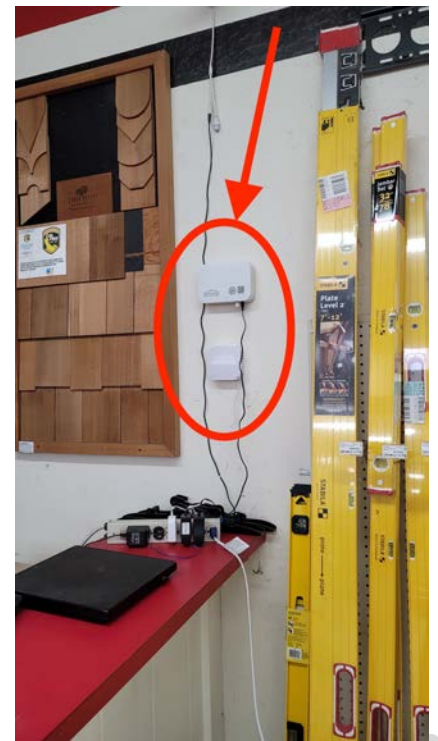
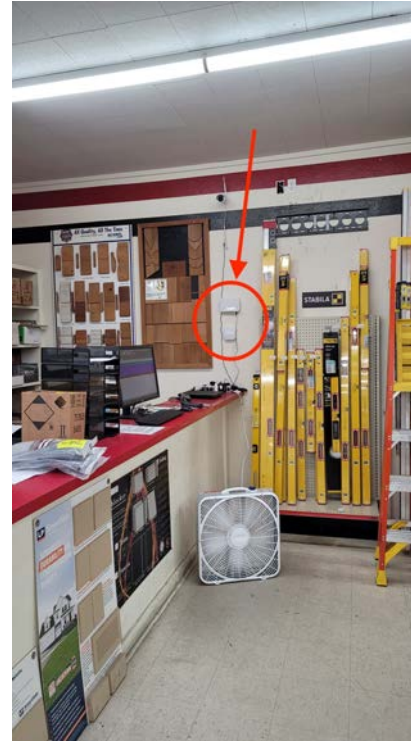
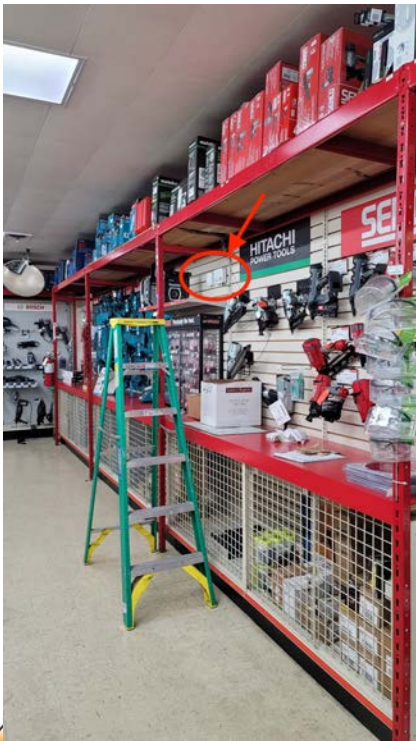
Commercial Monitors



VENTACITYSYSTEMS

Making Buildings Healthy - Efficient - Smarter

senseware



Sensor Integration

Robot

NETATMO



Works with
Apple HomeKit

wemo

SmartThings

hue
PHILIPS

Works with
IFTTT



alexa



Role of the contractor and role of the device

This is the ultimate engagement tool.

It is useless unless you the contractor
fully engage the client.

The success of the IAQ monitor is dependent on the contractor – more than the device, or the client.

Recommended - share one with technicians and staff.





Joe Medosch

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Peter Troast

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FREE Tool for Occupants



85,000+ Individual Scores

Joe Medosch

Healthy Building Scientist



House Type



Occupant Behaviors



Occupant Health Symptoms

Determine if your home is impacting your health!





APPENDIX



IAQ Devices - Where are They Now and Who is Using Them and for What?



Les Lazareck



Steve Byers



Peter Troast



Linda Wigington



Kaleb Saleeby



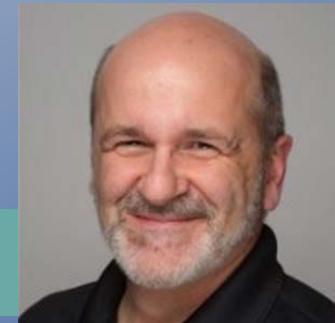
Brett Singer



Steve Mann



Kevin Kennedy



Bill Spohn

- AirVisual Pro
- Awair 2nd Edition
- Clarity Node
- Foobot
- Kaiterra Laser Egg CO2
- uHoo
- Netatmo

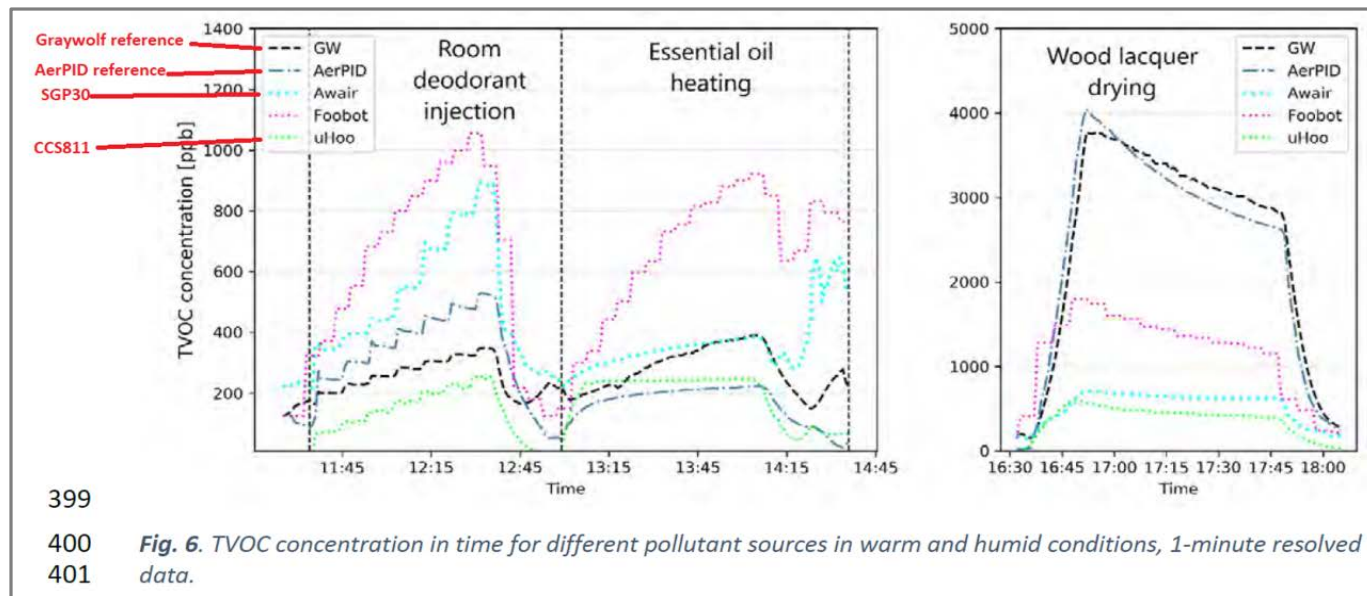
bit.ly/3duH7mp

Performance assessment of low-cost environmental monitors and single sensors under variable indoor air quality and thermal conditions



Performance assessment of low-cost environmental monitors and single sensors under variable indoor air quality and thermal conditions

<https://indoor.lbl.gov/publications/performance-assessment-low-cost>



Dr. Brett Singer
Leader - Mechanical Staff Scientist/Engineer

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

www.aqmd.gov/aq-spec

Sensors
AQ-SPEC Home
Sensors
Evaluations +
Submit a Sensor
Special Projects +
Resources +
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Dylos - DC1700-PM



2B Technologies - POM



Acrobotic - Smart Citizen Kit



Edimax - EdiGreen Home



Aeroqual - S500 (OZU 0-0.15)



Aeroqual - S500-PM



Kaiterra - Laser Eye 2+



Kunak - Air A10



FabLab - Smart Citizen Kit V2.1



Foobot



PurpleAir PA-II



PurpleAir PA-I-Indoor



HabitatMap - AirBeam



HabitatMap - AirBeam2



RTI - MicroPEM



SainSmart - Pure Morning P3



Hanvon-N1



IQAir - AirVisual Pro



Samsung S&C - SY-DS-DK3



Sensirion - Nubo



Sensirion - SPS30 Eval Kit



Shinyei - PM Evaluation Kit

