



**CLEANAIR**  
GROUP

**AtmosAir**  
SOLUTIONS

**BIOCLIMATIC**  
AIR SYSTEMS

## Making an Impact Over Four Decades

*It's all part of **how we deliver** a clearer vision of what's possible with **better air** – and **turns** the invisible into something incredible.*

*95% of the top 30 MEP firms by revenue have specified AtmosAir.*



**300M+**  
Square Feet Installed



**200M+**  
Square Feet Installed

### Clean Air Group

- Headquartered in Fairfield, CT.
- Established in 1982
- CAG branded patented bipolar ionization (BPI) air treatment technology as AtmosAir in 2004
- 500M+ Square Ft Installed
- Partnered with KeyTronicEMS manufacturing
- Granted 10+ technology patents with 20+ pending patents.
- Offices in Arizona, London, Dubai, Shanghai

## Comprehensive Air Cleaning and Monitoring Technology Portfolio



### AtmosAir Solutions

- AtmosAir™ Bi-Polar Ionization - Tube Dielectric Barrier Discharge
- AtmosSmart™ IOT
- AtmosAware™
- AtmosAware Mini
- Indoor Air Quality Sensors



### Bioclimatic Air Systems

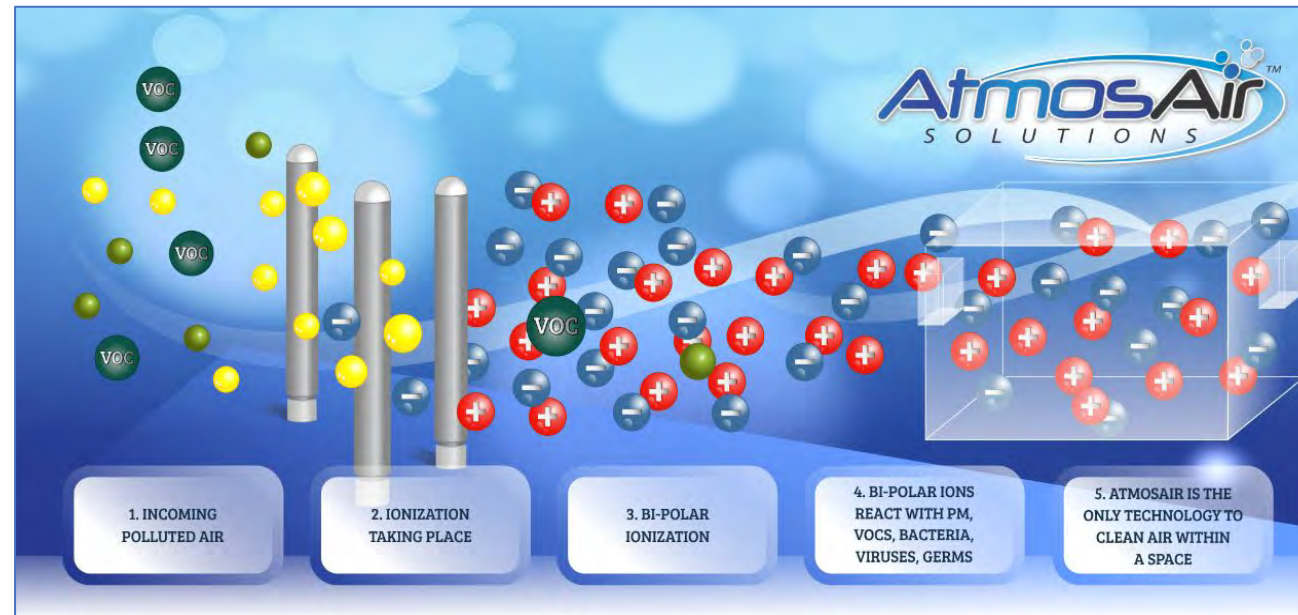
- Bioclimatic ActiveOx™ BPI
- Biotronic™ Filters - Powered Hi-E Particulate Filtration
- Bioclimatic Compact Ceiling Units (MC Series)
- Bioclimatic UV Germicidal Irraditaion
- Bioclimatic Chemical Media
- Bioclimatic PCO (Photocatalytic Oxidation)
- Bioclimatic Kitchen Exhaust Odor and Grease Control Units
- Bioclimatic Custom Air Handling and Filtration Solutions

## AtmosAir Selected World Class Customers in Core Market Verticals





## How It Works | AtmosAir Bi-Polar Ionization



- AtmosAir leverages a patented and proprietary Dielectric Barrier Discharge (DBD) Bi-Polar Ionization technology to generate positively and negatively charged air ions.
- AC Current applied to a controlled electrode (AtmosAir composite tube) produces a plasma across tube (Ionization Field), much like a Light Bulb Filament creates light.
- AtmosAir BPI increases ion concentration by 3-4x ambient (500-1500 ions/cm<sup>3</sup>) replicating ion rates found in pristine outdoor environments.
- AtmosAir Ion Lifespan: 300 seconds
- Verified Ozone Free Technology – UL 2998/UL867A Certified

## How It Works | AtmosAir Bi-Polar Ionization

### AGGLOMERATION



*Snowflakes are a product of ice crystal agglomeration. Ice crystals build up, become heavier than air, then precipitate to the ground. This same principle applies to dust agglomeration via air ions.*

Image Credit: Marc Newberry / Unsplash

### STERILIZATION



*Bacteria, like E. Coli shown above, are neutralized when air ions pull hydrogen molecules away from the cell wall, dehydrating the cell and hindering its ability to interact with other organisms.*

Image Credit: Eric Erbe, USDA / Wikimedia commons

### OXIDATION



*The iconic green patina on the Statue of Liberty is not original. It formed naturally over time from the same chemical process that breaks down VOCs and other noxious gasses in the atmosphere.*

Image Credit: Brandon Mowinkel / Unsplash

## Active Virus Inactivation | AtmosAir Bi-Polar Ionization

How AtmosAir Inactivates Viruses:



Positive (+) and negative (-) ions are introduced into the air via the AtmosAir system. OH radicals are formed when ions attach to the proteins that protrude from the membrane of a virus.



The OH radicals steal hydrogen from the virus, and return to the air as water, leaving holes in the membrane.



The destroyed proteins leave holes in the membrane, inactivating the virus.



# AtmosAir 500 Series | Large AHUs and RTUs



**508F  
C**

**ELECTRICAL**

Voltage.....	110/250 V
Frequency.....	50/60 hz 1 phase
Power Consumption.....	49 Watts
Current Draw.....	240 mA
Internal Fuse.....	500 mA
Field Electrical Connection.....	Junction Box

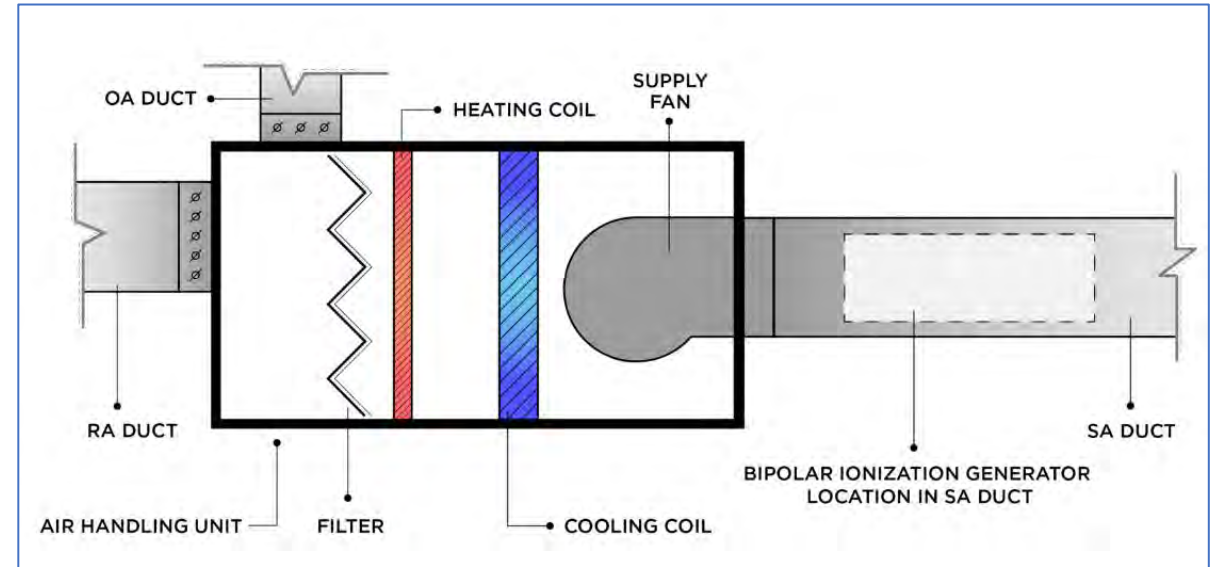
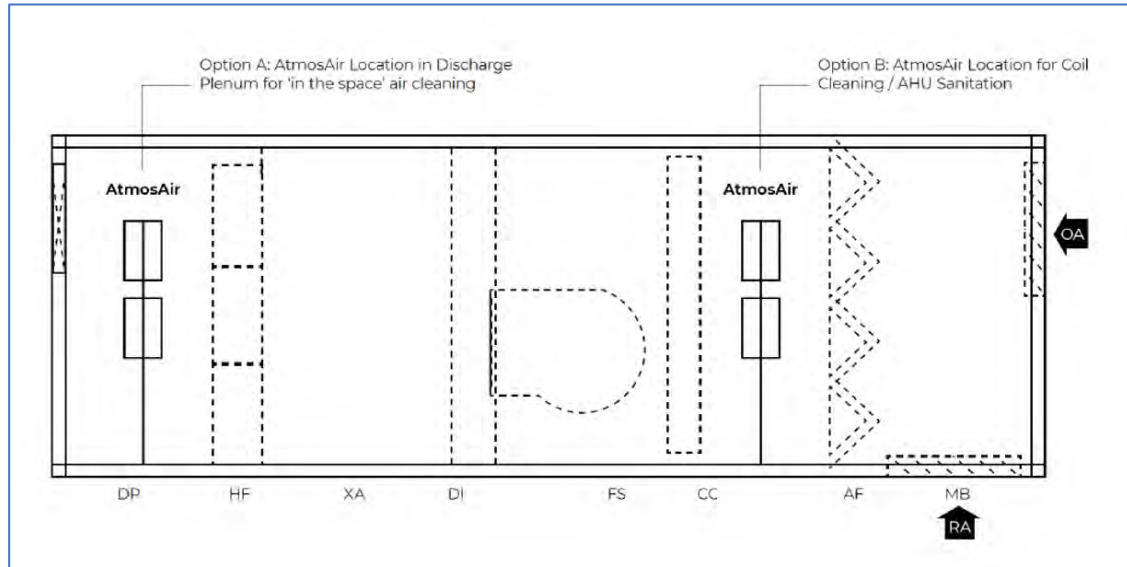


**500F  
C**

Large Induct Systems		
	508FC	500FC
Number of Tubes	8	5
CFM	16,000	10,000

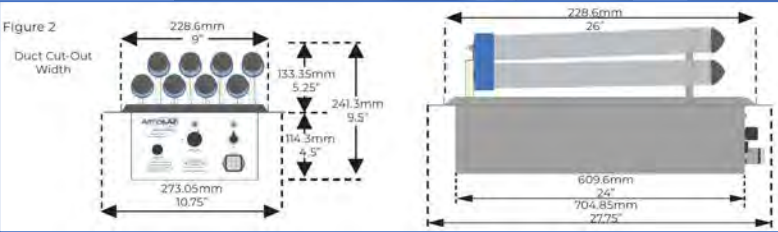


# AtmosAir 500 Series Installation | Large AHUs and RTUs



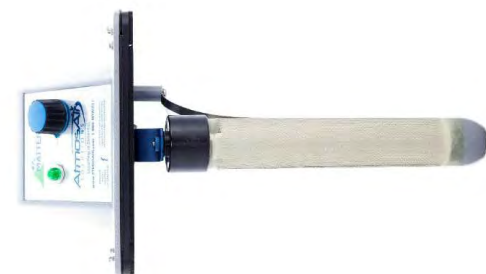
**AtmosAir can be mounted in an AHU or RTU, or it can also be mounted in a supply duct.**

# AtmosAir 500 Series Installations | Large AHUs and RTUs





# AtmosAir Matterhorn Series | AHUs 12-tons and Less



**Matterhorn 1000 (1-tube)**



**Matterhorn 1002 (2-tubes)**

## PRODUCT SUBMITTAL

# Matterhorn 1002





### APPLICATION

The Matterhorn 1002 ionization system is intended to be mounted in the supply duct or air handler of a heating, cooling, or ventilating system. The unit is intended to operate only when air flow is present, thus, power to the ionization unit should be interlocked with fan operation, or controlled via an air pressure switch. The size and number of ionization systems is dependent upon the airflow, size of the space, and severity of the pollution and odors. Ionization can be adjusted with a knob.

#### Optional/Available

- Air Switch
- Mounting Bracket
- Timer
- Remote Monitoring Panel

Figure 1

Tube Size	Tube Number	Flowrate (CFM)	mm / inch of WG	Pascals Pa	Steady State mA
C	(2)	2,000	0.2032mm / 0.0080"	2.00	34.00
D	(2)	3,000	0.6121mm / 0.0241"	6.00	35.00
E	(2)	4,000	1.2243mm / 0.0482"	12.00	35.00
F	(2)	5,000	1.7348mm / 0.0683"	17.00	37.00

Figure 2



### SPECIFICATIONS

#### General Product Information

Air Flow Rating	Up to 5,000 CFM
Pressure Drop	Minimal
Housing Material	Flame-Rated, High Impact ABS
Weight	2.83 kg (6.25 lbs)
Max Operation Temp.	65.6°C (150°F)

#### Electrical

Rated Voltage	120 VAC
Frequency	50/60 Hz
Power Consumption	6 Watts
Current Draw	0.4 Amps (400 mA)
Fuse	1.25 Amp 120 VAC   1.0 Amp 240 VAC

Field Electrical Connection: Junction Box Integrated into AHU

#### Ionization Tube

Material	Multi-Core Composite
Max Quantity	Two (2)
Compatible Tube Sizes	C (177.8mm) (7") D (243.8mm) (9.6") E (355.6mm) (14") F (558.8mm) (22")
Estimated Tube Life	17,600 Hours (Two Years)

#### Dimensions

See Figure 2 for more details

#### Approvals

CE, UKCA and Intertek ETL to UL Standards: 2996, 1995, 1995, 867, 867A; CSA 22.2; Zero Ozone Emissions, Heating & Cooling Equipment. Electrostatic Air Cleaners, Commercial/Industrial Indoor Air Quality.

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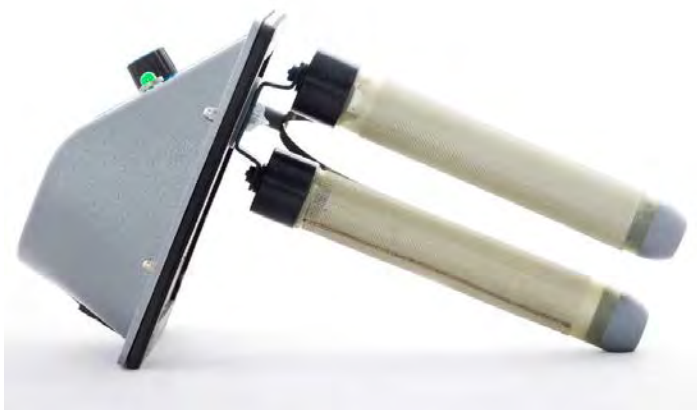
AtmosAir Solutions™  
CAG-09-21-003



# AtmosAir Matterhorn Series | AHUs 12-tons and Less



Matterhorn 1000 (1-tube)



Matterhorn 1002 (2-tubes)

## PRODUCT SUBMITTAL

# Matterhorn 1002



### AtmosAir SOLUTIONS

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### Figure 2



152.4mm 6"

139.7mm 5.5"

222.25mm 8.75"

### Figure 1

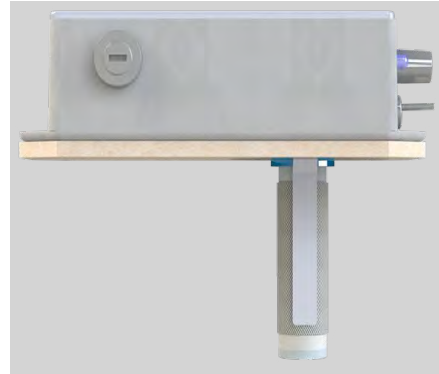
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AtmosAir Solutions™  
CAG-09-21-003

# AtmosAir FC Series | Fan Coils, PTAC, Univents, Heat Pumps



AtmosAir FC400



AtmosAir FC400-FM



AtmosAir FC400

## SPECIFICATIONS

Air Flow Capacity.....up to 1,400 CFM  
 Pressure Drop.....Minimal (see Fig. 1)  
 Housing Material.....ABS UL94-V0  
 Weight......70 pounds  
 Maximum Operation Temperature.....150° F (65.5° C)

## ELECTRICAL

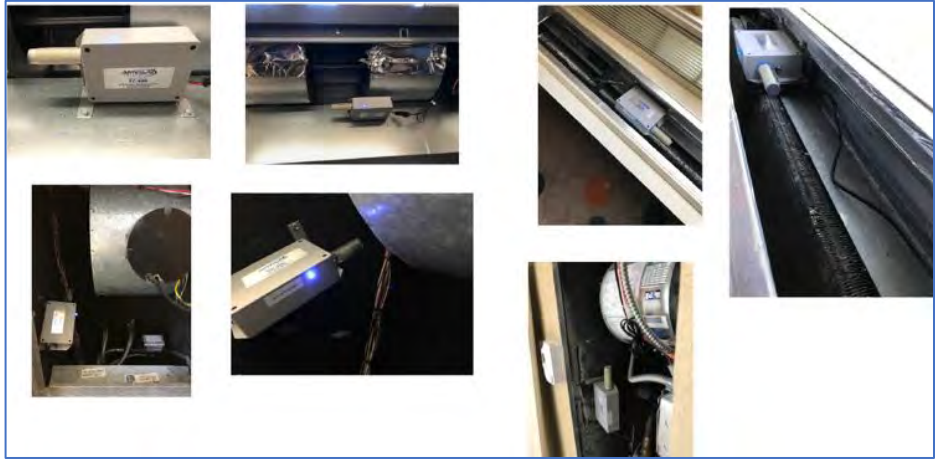
Voltage.....12 VAC  
 Frequency.....50/60 Hz  
 Power Consumption.....5 watts  
 Current Draw.....0.1 amps  
 Internal Fuse.....N/A  
 Field Electrical Connection.....110V/220V Receptacle

## IONIZATION TUBE

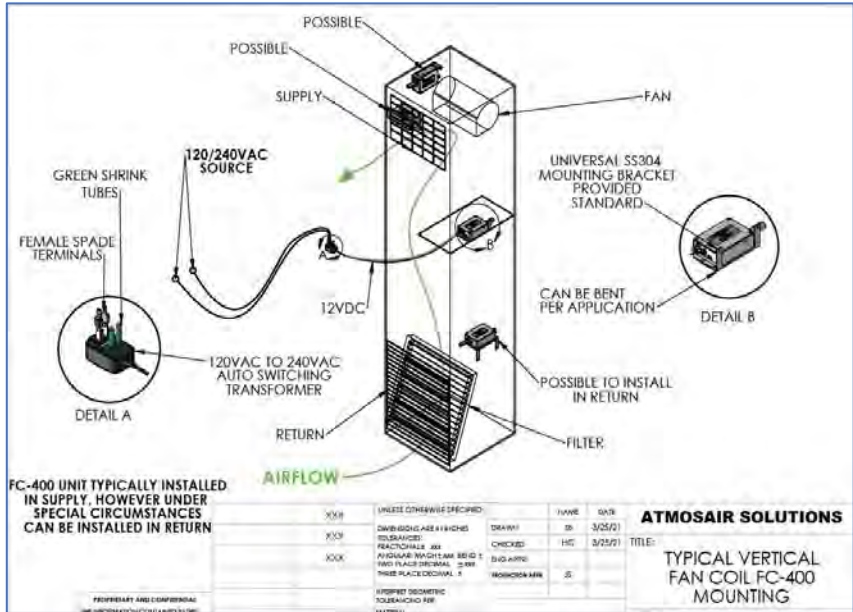
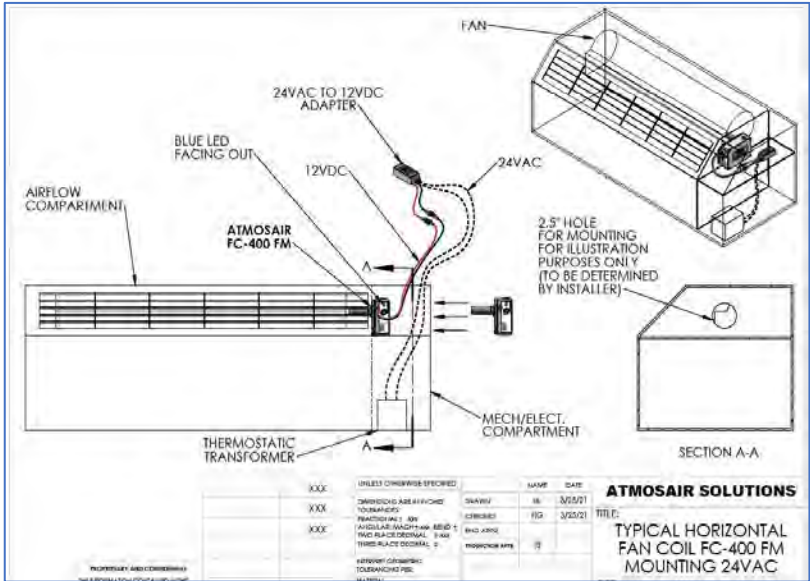
Material.....Glass, Stainless Steel  
 Number.....One (1)  
 Size.....B (3")  
 Tube Life.....8,800 Hours  
 Options: Air Switch, universal stainless steel mounting bracket



# AtmosAir FC Series Installations



- FC400 wires easily across the low voltage thermostat controls (24V). Wire parallel to the “call for fan” which is industry wide the green and red wires. Unit runs when the fan comes on.
- The FC400 can also be tapped into the fan motor leads (120/240 VAC) and the unit will come on with the fan.



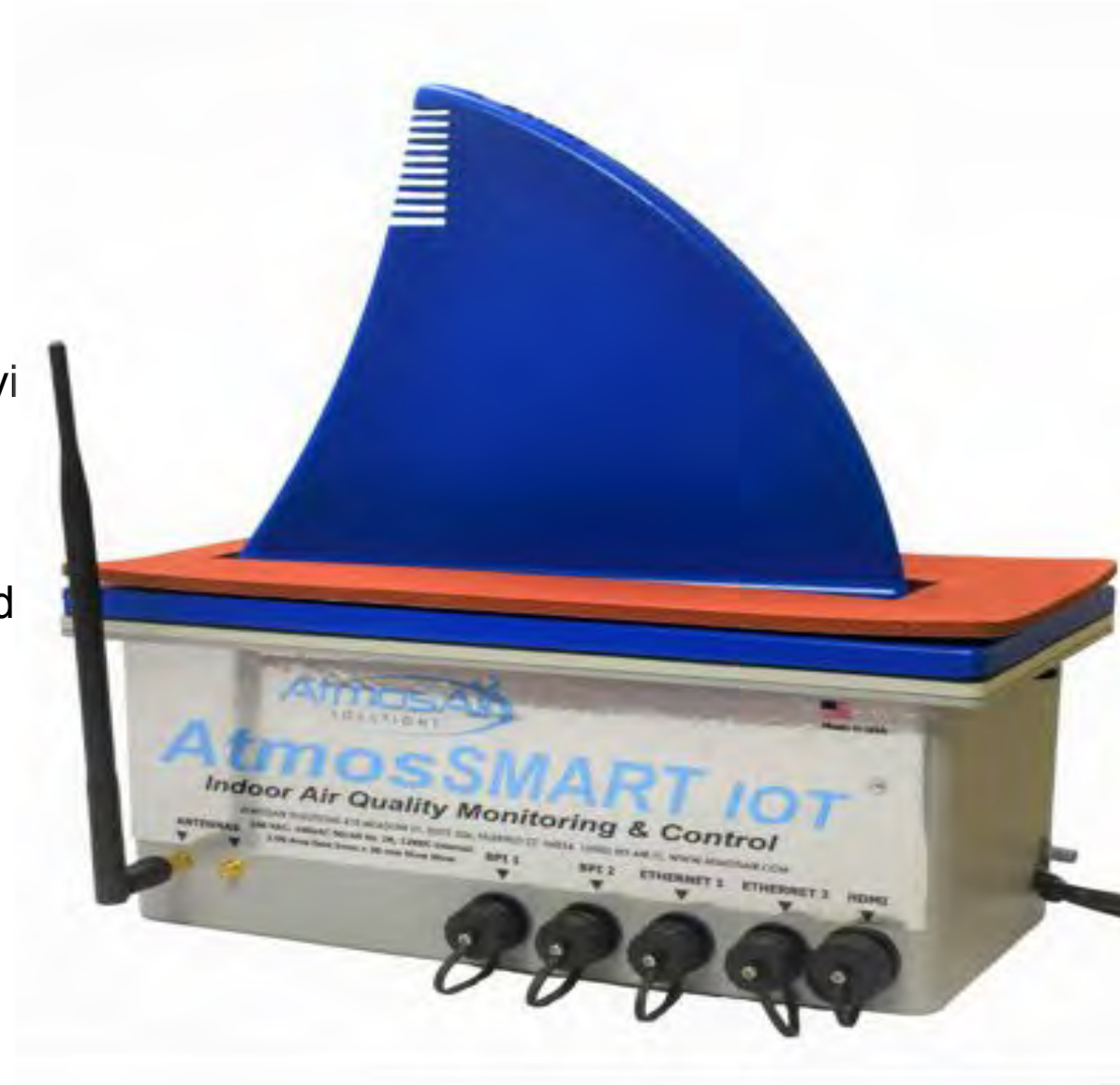




# **Measurement, Verification, and Controls**

## AtmosSmart IoT

- Continuously & actively measures 10 parameters of IAQ
  - Measures outdoor AQI as displayed from EPA data
- LTE Cellular Gateway for wireless communication
  - System does not require Wi-Fi or Ethernet connectivity
- Long range communication enabled via LoRa™ WAN
  - Accessible through web portal or mobile application
- Up to 8 AtmosAir™ ionization systems actively monitored controlled
  - 500 Series & Matterhorn Series compatible



**CLEANAIR**  
GROUP



PIONEERING THE FUTURE  
OF HVACR TECHNOLOGY

CO-SPONSORS

AHREXPO



AIRI

## NEW AtmosSmart IoT Value Add Benefits

- RESET Certified
- Cellular Gateway for independent communication
- No Wi-Fi or Ethernet needed
- BMS compatible via BACnet; BTL Certified
- Fully remotely programmable
- Only in-duct IAQ Monitor that monitors 10 parameters of air quality; plus, outdoor AQI
- Only device that can actively control BPI levels to changes in air quality (patent pending)
- Field serviceable to replace individual sensor cards or sensor bank tray; no need to dismount the fin installed into the duct work; no full unit replacement needed





# Clean Air Group Health Air as a Service IoT Platform

- All-in-one: Equipment, Installation, Monitoring, Maintenance & Service
- User can access their IAQ data and control devices from any internet connected device
- Web/Mobile App View for IAQ Data and device administration
- Manage Connected Device Alerts & Export Data Reports



# AtmosAware Sensedge In-Room Air Quality Monitoring

## 24/7 ACCURATE REAL TIME IAQ MONITORING

- PM2.5
- AQI
- TVOC
- CO2
- Temperature
- Humidity

## DISPLAY

- Local Outdoor Air Quality
- Indoor Air Quality
- Phone App, BACnet, WiFi, Ethernet



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## AtmosAware Mini

**AtmosAware™ Mini** sensors measure and validate indoor air quality on a real time basis.

The AtmosAware Mini Indoor Air Quality (IAQ) monitoring system measures the same points AtmosAware does **without a screen.**

Extra Features:

- The mini has additional installation options
- Stores the last hour of information
- Dashboard & app plus an open API, cloud storage, wi-fi, ethernet modbus option
- Option for an O3 sensor

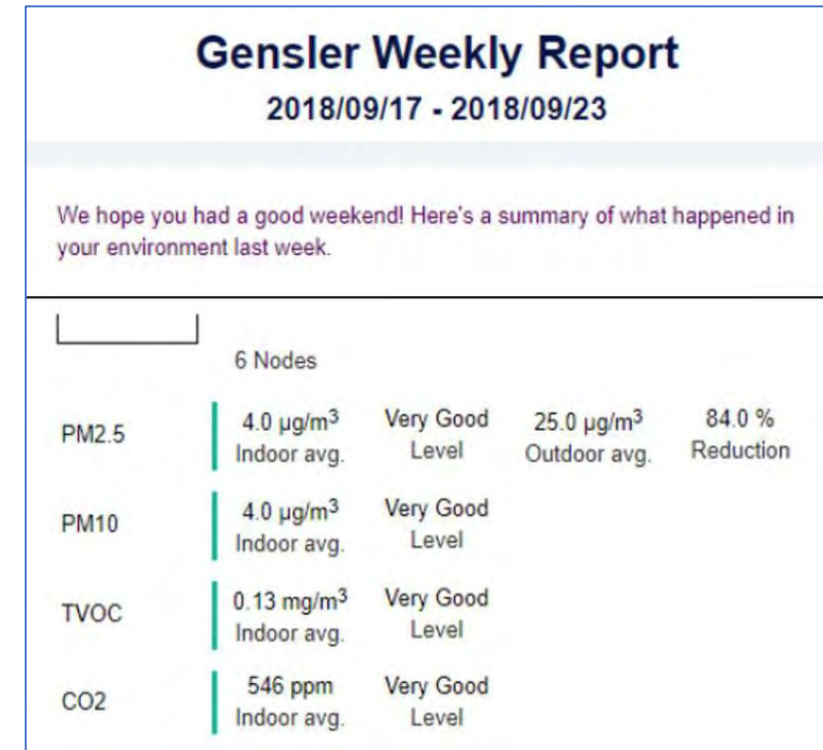
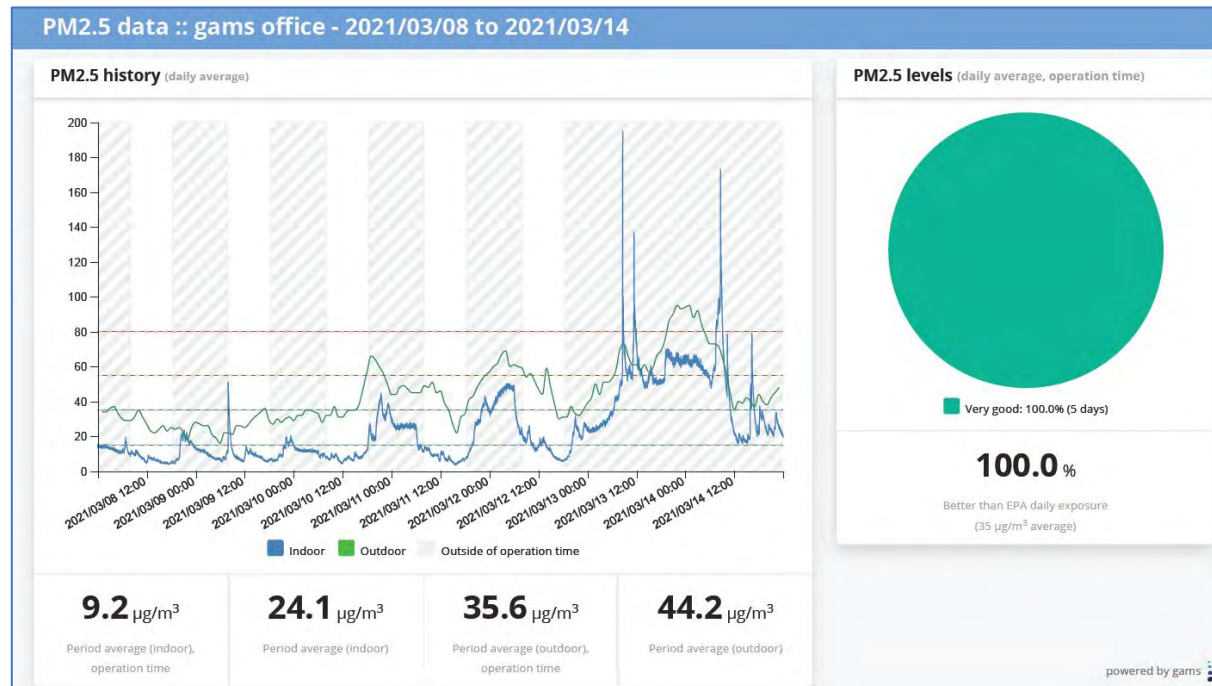
*Check current measurements or analyze historical levels to detect important changes. Provides data reports on air quality.*



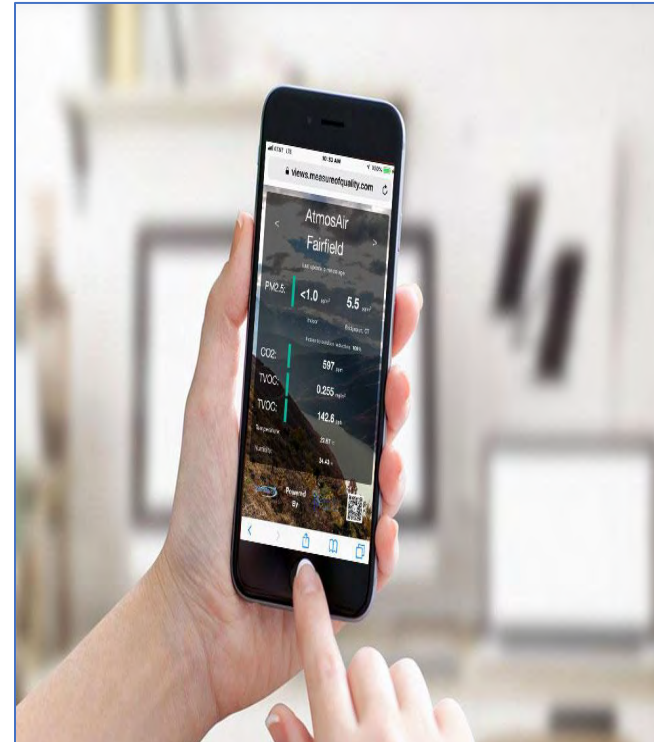


# Reporting and Analytics

## Cadenced Weekly Auto Generated Reports



# Custom Digital Displays and IAQ Reporting

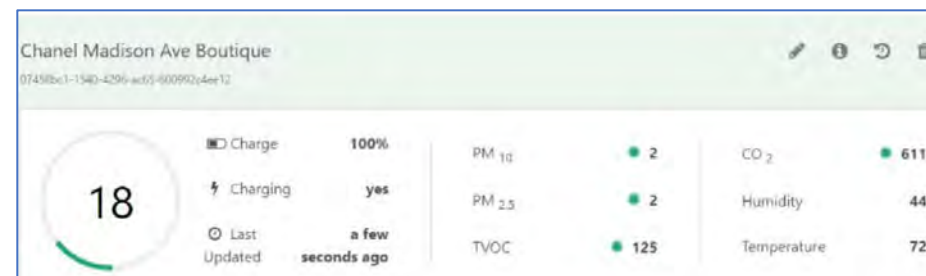


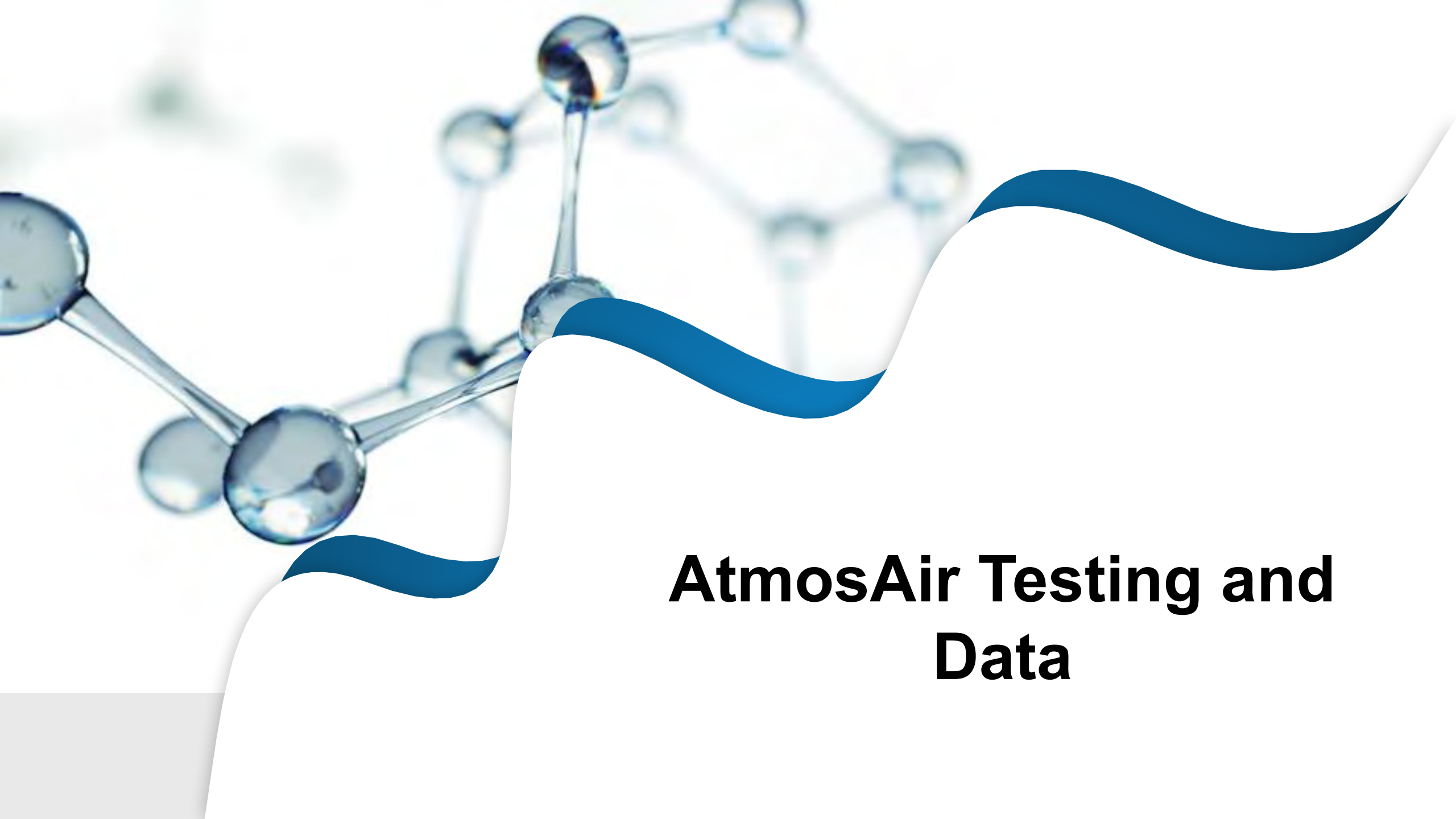
### Gensler Weekly Report

2018/09/17 - 2018/09/23

We hope you had a good weekend! Here's a summary of what happened in your environment last week.

6 Nodes				
PM2.5	4.0 µg/m <sup>3</sup> Indoor avg.	Very Good Level	25.0 µg/m <sup>3</sup> Outdoor avg.	84.0 % Reduction
PM10	4.0 µg/m <sup>3</sup> Indoor avg.	Very Good Level		
TVOC	0.13 mg/m <sup>3</sup> Indoor avg.	Very Good Level		
CO2	546 ppm Indoor avg.	Very Good Level		





# **AtmosAir Testing and Data**





## Academic Studies and Peer-Reviewed Research | Bi-Polar Ionization

**Over 50 peer-reviewed studies support the science of controlled air ionization for improvement of indoor environmental quality.**

While sometimes referred to as an “emerging technology,” bi-polar ionization generated by dielectric-barrier discharge has a long history of reducing airborne particles and aerosols within a built environment.

Many academic and public institutions around the world are developing BPI technologies for improvement of indoor environmental quality.

# Study Report – Coronavirus 229E



Test Report | Microchem Laboratory

## Study Title

Virucidal Efficacy of a Test Substance For Use on Inanimate, Nonporous Surfaces

## Standardized Test Method

ASTM E1053

## Maximum Ionization Rate

1,500 ions cm/3

## Test Result

The presence of coronavirus was reduced by 99.92% within 30 minutes of exposure to DBD BPI

Test Results at 30 minutes

		Test Results Replicate 1 30 minutes	Test Results Replicate 2 30 minutes	Test Results Replicate 3 30 minutes
Cell Control		0 0 0 0	0 0 0 0	0 0 0 0
Dilution	10 <sup>-1</sup>	0 0 0 +	0 0 0 +	0 0 0 0
	10 <sup>-2</sup>	0 0 0 0	0 0 0 0	0 0 0 0
	10 <sup>-3</sup>	0 0 0 0	0 0 0 0	0 0 0 0
	10 <sup>-4</sup>	0 0 0 0	0 0 0 0	0 0 0 0
	10 <sup>-5</sup>	0 0 0 0	0 0 0 0	0 0 0 0
TCID <sub>50</sub> per 0.1 ml		0.75 Log <sub>10</sub>	0.75 Log <sub>10</sub>	≤0.50 Log <sub>10</sub>
TCID <sub>50</sub> per Carrier		1.05 Log <sub>10</sub>	1.05 Log <sub>10</sub>	≤0.80 Log <sub>10</sub>
Average Log <sub>10</sub> Reduction		2.78 Log <sub>10</sub>		
Average Percent Reduction		99.92%		

Key: + = Virus recovered; 0 = Virus not recovered and/or no cytotoxicity observed;  
T = Cytotoxicity observed; †Taking cytotoxicity and neutralization controls into account.



## Air Ionization for Indoor Environments for the Control of Volatile and Particulate Contaminants with Nonthermal Plasmas Generated by Dielectric-Barrier Discharge

Peer Review Publication: IEEE, Plasma Science, Volume 30, August 2002

Dr. Stacy L. Daniels, PhD. and Professor of chemical and environmental engineering at University of Michigan is an expert in Indoor Environmental Quality (IEQ). He also was associated with The Dow Chemical Co. in a variety of environmental positions.

'Air Ionization for Indoor Environments' is one of the most in-depth papers that has been written on the chemistry and physics of dielectric-barrier discharge bi-polar air ionization with over 90 citations.

Real-world case studies and data are detailed.

Intelligent AtmosAir BPI technology closely relates to the DBD technology discussed in this paper.

<https://ieeexplore.ieee.org/document/1167642>



## Application of corona discharge-generated air ions for filtration of aerosolized virus and inactivation of filtered virus

Peer Review Publication: Journal of Aerosol Science, 2017

The research team studied the effect of corona discharge-generated air ions on the filtration of aerosolized bacteriophage MS2. An ionization system was installed upstream of a medium-efficiency air filter to generate air ions, which were used to charge the virus aerosols and increase their filtration efficiency. After the virus aerosols were captured by the filter for a certain time interval, they were exposed to a newly incoming air ion flow. Captured virus particles were detached from the filter by sonication, and their antiviral efficiency due to air ions was calculated by counting the plaque-forming units. The antiviral efficiency increased with ion exposure time and ion concentration. When the concentration of positive air ions was 107 ions/cm<sup>3</sup>, the antiviral efficiencies were 46.1, 78.8, and 83.7% with exposure times of 15, 30, and 45 min, respectively.

When the ionization system was operated in bipolar mode, the number concentrations of positive and negative ions were  $6.6 \times 10^6$  and  $3.4 \times 10^6$  ions/cm<sup>3</sup>, respectively, and the antiviral efficiencies were 64.3, 89.1, and 97.4% with exposure times of 15, 30, and 45 min, respectively.

<https://pubmed.ncbi.nlm.nih.gov/32226115/>



## Ionizing air affects influenza virus infectivity and prevents airborne-transmission

Peer Review Publication: Nature Portfolio, Scientific Reports, 2015

This study showed that an ionization system can remove influenza A virus infection from the air.

In a study completed with guinea pigs, in a room with an ionizer where the virus was released into the air, none of the guinea pigs were infected.

This study concluded 'the device enables unique possibilities for rapid and simple removal of virus from air and offers possibilities to simultaneously identify and prevent airborne transmission of viruses.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4477231/>



## Evaluation of a bipolar ionization device in inactivation of antimicrobial resistant bacteria, yeast, Aspergillus and human coronavirus

Peer Review Publication: Journal of Hospital Infection, 2022

A 4 h exposure to bipolar ionisation showed a 1.23 to 4.76 log reduction corresponding to a 94.2 to >99.9% cfu/gauze reduction for *Clostridioides difficile*, KPC-producing *Klebsiella pneumoniae*, methicillin-resistant *Staphylococcus aureus* and multidrug-resistant *Staphylococcus aureus*. Against human coronavirus, a 1.2 log TCID50 reduction was observed after 2 h.

The assessment of bipolar ionisation systems merits further investigation as an infection control measure.


Ozone levels measured were below levels reported to inactivate microorganisms.

<https://pubmed.ncbi.nlm.nih.gov/35452719/>





# 2022 ASHRAE Funded Study on DBD BPI



## ASHRAE Reporter

October 2020

### Fresno State Indoor Air Quality (IAQ) Research Project


1. Fresno State Indoor Air Quality (IAQ) Research Project

ASHRAE San Joaquin Valley has decided to promote the joint efforts of Fresno State and TETER AE to conduct a study on the feasibility of air cleaning technologies - like bipolar ionization - against more conventional methods. The board has recognized this as a great opportunity to promote healthy and more efficient built environments right here in the Central Valley. This project is currently seeking financial and material sponsorship from local engineering, manufacturing, and construction firms which have a vested interest in "reopening" our economy in the best way. To put it simply:

**WE NEED YOU!**

Please reach out to your ASHRAE SJV Chapter officers if you are interested in supporting this project. Project details below:

The recent SARS-CoV-2 outbreak has shed new light and renewed interest on the need for maintaining good Indoor Air Quality (IAQ). In doing so, technologies invented over the past 10 years have garnered interest as a means to combat the virus. One such technology is Bipolar Ionization (BPI). BPI manufacturers have claims of reducing or eliminating odors, VOC's, killing bacteria, and reducing air-borne particles that can't be commonly filtered. Manufacturers have conducted individual tests in controlled labs to show results related to Ozone creation, and effectiveness of the technology. However, 3rd party independent testing is largely absent.

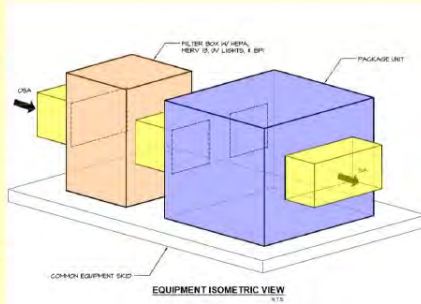


## ASHRAE Reporter

Page 2

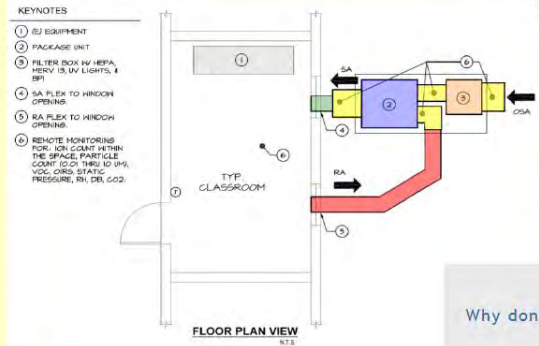
The Central Valley presents one of the biggest obstacles in achieving the states goals from an HVAC perspective. Most areas of the state can maximize outside air (OSA) to offset mechanical cooling or heating with favorable climates and reduced pollutants. The Central Valley cannot easily make this conversion because of its extreme heat and varying air pollution, caused by both SMOG and airborne dirt from local farming. As such, any additional OSA entering the building must be conditioned and filtered. However, if BPI technology can prove to be effective at filtering and purifying the return air to a point where OSA can be reduced or eliminated (as some manufacturers claim), then energy savings can be realized.

The objective of this study is not to test Bipolar Ionization (BPI) technology against SARS-CoV-2. The objective is to test Bipolar Ionization IAQ products in comparison with conventional MERV-13 filters, HEPA filters, and UV lights to improve IAQ and to save energy with reduced OSA flow rates.



**Equipment Needed:**

1. BPI Equipment
2. HEPA Filtering Equipment
3. UV Equipment
4. Metering and Measuring Equipment (e.g., dry-bulb temperature, relative humidity, static pressure, airflow velocity, particle counts, ion counts, VOC emissions, and OIRS)
5. Air Handler Equipment



**KEYNOTES**

1. BPI EQUIPMENT
2. PACKAGE UNIT
3. FILTER BOX W/ HEPA, MERV 13, UV LIGHTS, & BPI
4. SA FLEX TO HATCH OPENING
5. RA FLEX TO HATCH OPENING
6. REMOTE MONITORING FOR ION COUNT WITHIN THE SPACE, PARTICLE COUNT, CO2, TEMPERATURE, HUMIDITY, STATIC PRESSURE, RA, DB, CO2

**FLOOR PLAN VIEW**

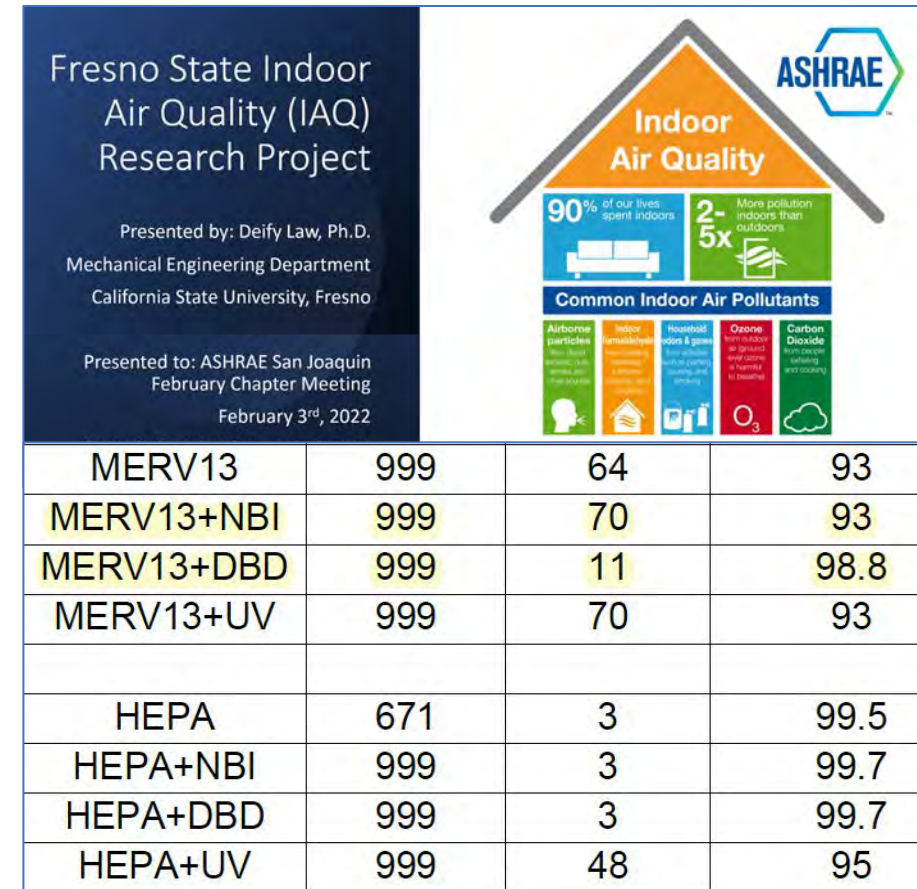
**Why don't they play poker in the jungle?**

Too many Cheetahs - BuzzFeed

CALIFORNIA STATE UNIVERSITY, FRESNO  
IAQ LAB

## 2022 ASHRAE Funded Study on AtmosAir BPI

- In February, 2022 data was released from the first ever ASHRAE funded research study involving Bi-Polar Ionization. AtmosAir Dielectric Barrier Discharge (DBD) technology was tested.
- MERV 13 physical air filter combined with AtmosAir (DBD device) closely matched the performance of a HEPA high efficiency filter in filtering fine particulate matter.**
- BPI air treatment devices combined with a physical mechanical filter generally delivered a better performance in reducing VOCs, formaldehyde, CO<sub>2</sub>, and PM 2.5 concentrations at the supply air duct compared with those filters without any BPI device.



## ASHRAE



Tony Abate is Clean Air Group's Co-Founder and Chief Technology Officer.

Dan Mason is Clean Air Group's Senior Product Specialist and is an ASHRAE Life Member.

Tony and Dan have each been working in ASHRAE within the air filtration category for over 20 years.

Tony and Dan remain members, liaisons, and/or voting members on various ASHRAE committees, most recently working on:

- **ASHRAE Funded Research Study on Air Cleaners including Bi-Polar Ionization | Fresno State University (2022)**
- Chairman SSPC 145 | **NEW Standard 145.2 now includes electronic air cleaners including BPI technologies**
- Member TRG2.RAST | **NEW standard and test procedure around electronic air cleaning technologies**
- Voting member TC2.3 | Gaseous Air Contaminants and Gas Contaminant Removal Equipment
- Voting Member TRG 4 IAQP | **NEW Committee developing guidance to allow users to apply the ASHRAE 62.1 IAQP method)**
- Member SSPC 185 | Developing **NEW 185.3 test method (Laboratory Test Method of Testing In-Room Devices and Systems for Microorganism Removal or Inactivation in a Chamber)**
- Member AHAM AC-5 | **NEW Microbial Reduction Task Force Committee**
- Voting Member of TC4.3 | Ventilation and Filtration in buildings
- Committee member | ASHRAE Position on Filtration Document
- Member ASHRAE 209 | Ultraviolet Air and Surface Treatment



## AtmosAir Products Are Certified Ozone Free

*UL2998 Certified*

*UL867 and UL867A Certified*

*Continuous Monitoring with  
AtmosSmart*

*Patented AtmosAir non-thermal  
plasma discharge by a  
dielectric barrier discharge.*



**ASHRAE/CDC: BPI Systems may emit ozone. Manufacturers are likely to have ozone generation test data. When considering the acquisition and use verify that the equipment meets UL 867 standard certification (Standard for Electrostatic Air Cleaners) for production of acceptable levels of ozone, or UL 2998 standard certification (Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners) which is intended to validate that no ozone is produced.**

# AtmosAir Real World Testing USA

Client	CO <sub>2</sub> Before (PPM)	CO <sub>2</sub> After (PPM)	PM10 Before (ug/m <sup>3</sup> )	PM10 After (ug/m <sup>3</sup> )	PM2.5 Before (ug/m <sup>3</sup> )	PM2.5 After (ug/m <sup>3</sup> )	TVOC Before (PPM)	TVOC After (PPM)	Laboratory Mold Testing	Indiv. VOC Element Testing	Ozone Before	Ozone After	Energy Project
US Department of Defense	614	576	24	7	19	5	n/a	n/a	✓ (-41%)	n/a	n/a	n/a	✓
California Public School	847.5	798.5	23.1	31.37	6.65	6.2	69.25	1.65	✓	n/a	0	0	✗
Arena - Los Angeles, CA	560	470	25	19	n/a	n/a	13	0	✗	Yes	0.015	0	✓
Global Banking Institution 1 - New York, NY	991	1006	6	4	1	1	40	21	✗	n/a	0	0	✗
Florida-based Power Utility Company - Plantation, FL	1046	693	15	6	10	4	5	0	✗	n/a	0	0	✓
Largest Global Architecture Firm - Los Angeles, CA	639	609	6	2	5	3	25	8	✗	n/a	0.024	0	✗
Fairfield County Public Schools - Westport, CT	1007	769	12	7	7	1	2	0	✓ (-95%)	n/a	0.001	0	✗
Global Hotel & Resort - New York, NY	491	477	7	6	5	4	10	0	✗	n/a	0	0	✓
Global Banking Institution 2 - New York, NY	485	689	4	2	3	2	8	1	✗	n/a	0	0	✗
Global Banking Institution 3 - New York, NY	726	736	7	8	4	1	150	2	✗	n/a	0.005	0.004	✗
Casino (100k Sq Ft Gaming Space) - Pittsburgh, PA	589	799	91	88	88	96	150	28	✗	n/a	0	0	✗
Vivarium - New York	3000	2995	13	14	1	1	150	116	✗	n/a	0	0	✓
Research - Los Angeles, CA	1087	776	62	17	2	1	22	8	✗	n/a	0	0	✗
Private Research University - Los Angeles, CA	n/a	n/a	9	2	14	2	17	2	✗	n/a	0	0	✓
Medical Center - New York	1268	1074	12	11	10	5	116	61	n/a	n/a	0.01	0.01	✗
West Coast Real Estate Conglomerate - CA	620	691	6	7	4	6	9	6	n/a	✓	0	0	✓
Arena - Nashville, TN	488	385	9	10	9	9	25	1	n/a	n/a	0.008	0	✗
Global Mass Media Company - New York, NY	804	829	5	2	6	2	150	20	n/a	n/a	0	0	✗
Big 4 Accounting Firm - Westlake, TC	508	514	9	7	7	6	150	53	n/a	n/a	0	0	✗
Global Bank Institution 4 - New Jersey	847	989	30	4	28	2	48	30	n/a	n/a	0	0	✗
American Multinational Hospitality Company - Chicago, IL	475	503	4	5	4	4	150	10	n/a	n/a	0	0	✗
Minnesota Public School	904	580	34	12	11	3	6	3	n/a	n/a	0	0	✓
Major Casino - Hollywood, FL			101	55	97	50	119	24	n/a	n/a	0	0	
Tower 45 - 120 West 45th St	1182	1200	6	3	5	2	18	11	n/a	n/a	0	0	✓

# New Rochelle School District Study

Guth DeConzo Consulting Engineers led a detailed study and tested over one hundred locations with AtmosAir installed.

<div><div><div></div><div>GUTH DeCONZO</div></div><div><div><div></div><div>DAVIS ELEMENTARY SCHOOL</div></div></div></div> <div><div>PROJECT:</div><div>New Rochelle School District IAQ Commissioning</div></div> <div><div>SCHOOL:</div><div>Davis Elementary School</div></div> <div><div>ADDRESS:</div><div>80 Iselin Dr, New Rochelle, NY 10804</div></div>					Test Results										Engineer's Initials
Testing Description					Average Negative Ion Concentration (per cm <sup>3</sup> )	Ozone Concentration (ppb)	VOC Concentration (ppm)	Formaldehyde Concentration (ppm)	Particle Count (per 1 ft <sup>3</sup> )						
Room	Trial	Start Time	End Time	Ionizer Type					0.3µm	0.5µm	1.0µm	2.0µm	5.0µm	10.0µm	
Music Room 43	Baseline	9/8/2021 1:20	9/8/2021 1:35	N/A	1,120	0.86	2.51	0.23	2,718,161	218,922	25,938	3,592	210	64	NEH
	Operating	9/8/2021 9:46	9/8/2021 10:01	Matterhorn	2,115	1.29	2.44	0.21	1,540,326	113,950	10,780	2,515	170	73	NEH
	Percent Change from Baseline					89%	50%	-3%	-9%	-43%	-48%	-58%	-30%	-19%	14%
Cafeteria	Baseline	9/8/2021 1:38	9/8/2021 1:53	N/A	1,320	1.45	2.22	0.23	2,617,871	165,114	11,837	1,492	342	124	NEH
	Operating	9/8/2021 10:15	9/8/2021 10:30	Matterhorn	1,991	1.49	1.92	0.19	1,359,461	87,057	5,144	975	183	133	NEH
	Percent Change from Baseline					51%	3%	-14%	-17%	-48%	-47%	-57%	-35%	-46%	7%
1st Floor Hallway	Baseline	9/8/2021 1:57	9/8/2021 2:12	N/A	984	1.13	2.21	0.2	3,917,922	429,324	20,179	2,198	230	112	NEH
	Operating	9/8/2021 10:34	9/8/2021 10:49	Matterhorn	1,840	1.15	2.2	0.16	2,842,917	219,662	11,488	1,721	236	140	NEH
	Percent Change from Baseline					87%	2%	0%	-20%	-27%	-49%	-43%	-22%	3%	25%
Audio Visual 116	Baseline	9/23/2021 4:04	9/23/2021 4:19	N/A	1,021	1.45	2.33	0.21	2,415,669	214,556	22,105	2,366	266	131	NEH
	Operating	9/23/2021 1:01	9/23/2021 1:16	Matterhorn	1,623	1.45	1.98	0.21	1,488,752	110,665	7,650	1,359	201	88	NEH
	Percent Change from Baseline					59%	0%	-15%	0%	-38%	-48%	-65%	-43%	-24%	-33%
2nd Floor Hallway	Baseline	9/8/2021 2:15	9/8/2021 2:30	N/A	1,210	0.83	2.05	0.23	4,109,165	410,198	19,273	2,689	1,532	243	NEH
	Operating	9/8/2021 11:15	9/8/2021 11:30	Matterhorn	1,690	0.84	1.97	0.2	2,272,896	186,500	9,123	1,800	941	154	NEH
	Percent Change from Baseline					40%	1%	-4%	-13%	-45%	-55%	-53%	-33%	-39%	-37%
Room 107	Baseline	9/8/2021 2:33	9/8/2021 2:38	N/A	1,305	0.46	2.03	0.22	2,010,933	111,901	6,292	872	107	79	NEH
	Operating	9/8/2021 11:41	9/8/2021 11:56	Matterhorn	2,544	0.57	1.75	0.18	994,117	58,769	3,720	705	76	89	NEH
	Percent Change from Baseline					95%	24%	-14%	-18%	-51%	-47%	-41%	-19%	-29%	13%
Room 109	Baseline	9/8/2021 2:41	9/8/2021 2:56	N/A	1,212	0.61	1.99	0.21	1,879,091	90,901	5,829	762	98	71	NEH
	Operating	9/8/2021 11:58	9/8/2021 12:13	Matterhorn	2,375	0.55	1.88	0.18	935,646	55,947	3,610	610	78	101	NEH
	Percent Change from Baseline					96%	-10%	-6%	-14%	-50%	-38%	-38%	-20%	-20%	42%
Room 108	Baseline	9/8/2021 3:01	9/8/2021 3:16	N/A	875	0.54	1.57	0.23	2,001,982	96,101	9,937	1,002	80	54	NEH
	Operating	9/8/2021 12:35	9/8/2021 12:50	Matterhorn	1,876	0.58	1.06	0.19	921,534	56,121	3,750	672	69	66	NEH
	Percent Change from Baseline					114%	7%	-32%	-17%	-54%	-42%	-62%	-33%	-14%	22%
Auditorium	Baseline	9/8/2021 3:20	9/8/2021 3:35	N/A	810	0.54	2.11	0.25	3,899,710	356,876	41,937	18,029	1,543	251	NEH
	Operating	9/8/2021 12:18	9/8/2021 12:33	Matterhorn	1,268	0.58	2.06	0.23	2,191,710	162,185	18,398	7,223	1,312	247	NEH
	Percent Change from Baseline					57%	7%	-2%	-8%	-44%	-55%	-56%	-60%	-15%	-2%



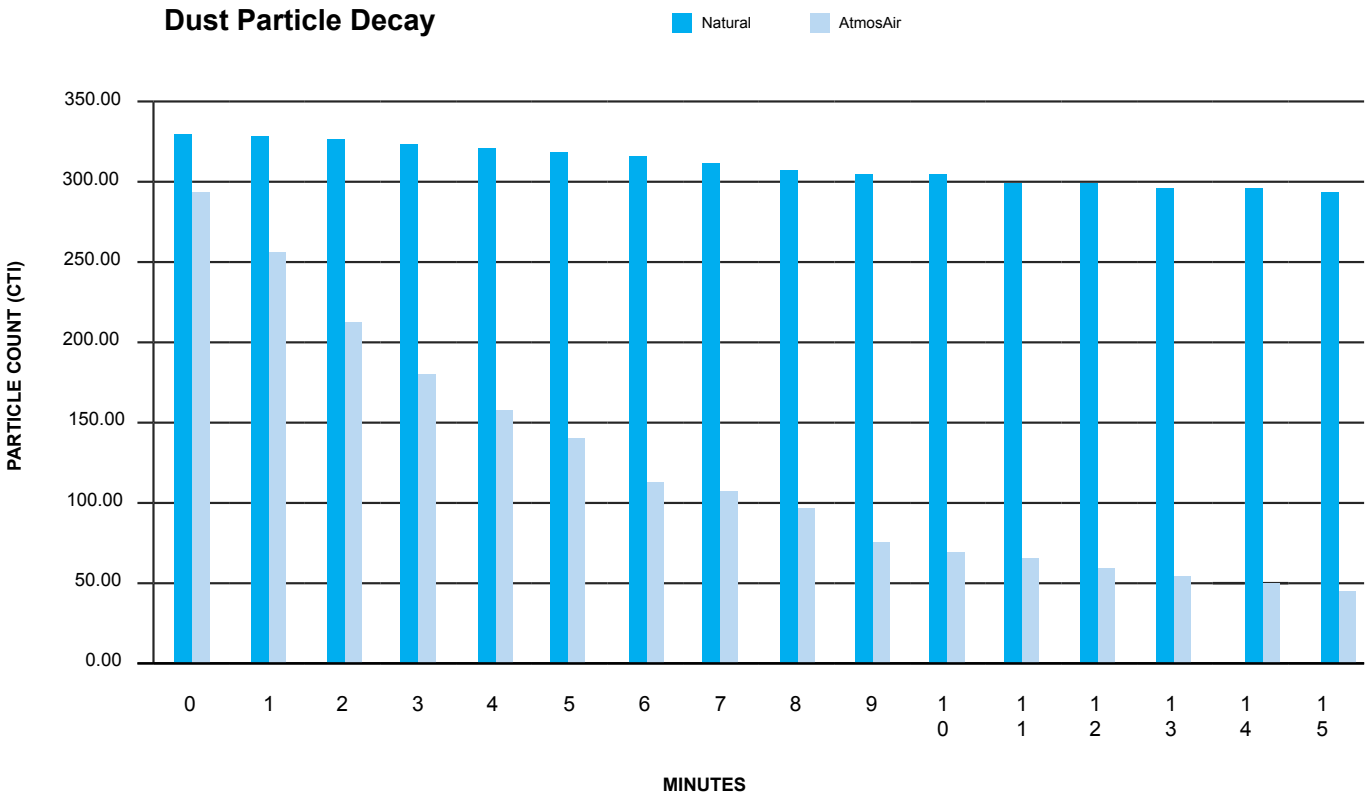
## Keurig Dr. Pepper | Case Study Results

KDP led a detailed study and tested over 27 locations with AtmosAir installed over 5 weeks.

Burlington Building 1 - AtmosAir Pilot (2020)				
	9/10/2020	9/30/2020	10/7/2020	10/14/2020
Performance Metric	Week 0 (installation)	Week 3	Week 4	Week 5
% Reduction of mean baseline ATP - <b>Floor 1</b>	19,390 RLU (baseline)	57.6%	63%	83%
No. (%) of sites swabbed showing LOWER ATP values vs. week zero - <b>Floor 1</b> (n = 27 sites)	N/A	18 sites (67%)	19 sites (70%)	24 sites (89%)
% Reduction of mean baseline ATP - <b>Floor 2</b>	12,751 RLU (baseline)	61%	70%	69%
No. (%) of sites swabbed showing LOWER ATP values vs. week zero - <b>Floor 2</b> (n = 22 sites)	N/A	16 sites (73%)	19 (86%)	20 (91%)



# Clean Air Delivery Rate (CADR) Test vs. Particulate Matter (0.3 Micron)

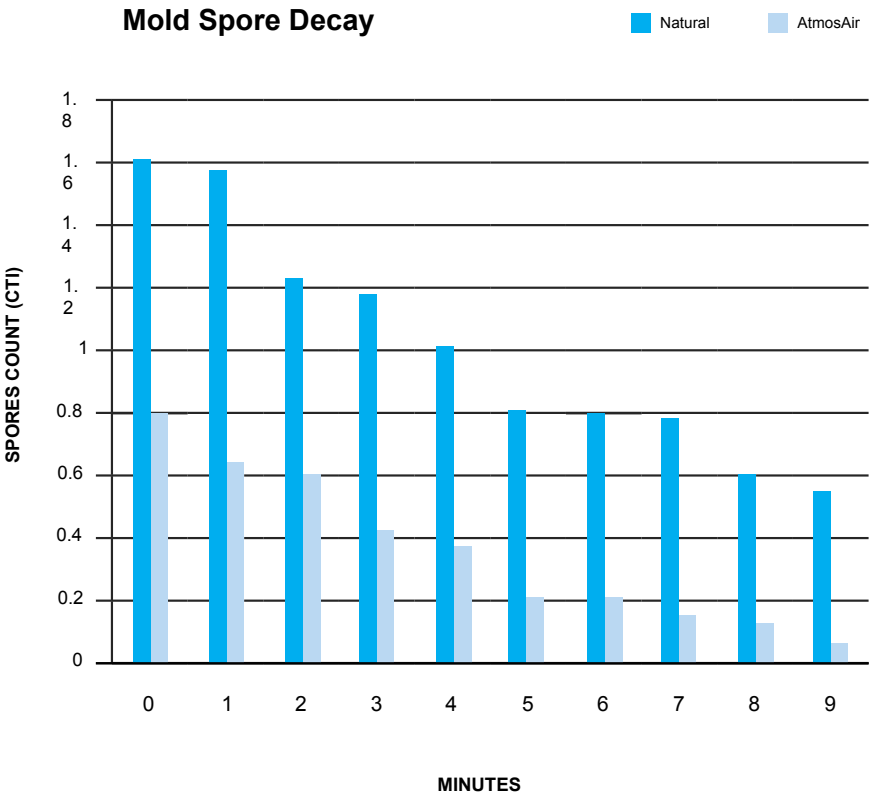


[Clean Air Delivery Rate Testing - Third Party Testing Against Particulate Matter \(PM\) with ETL.](#)

**Study Summary**

To an ANSI and AHAM structured CADR test vs. ultra-fine particulate matter (PM0.3), AtmosAir proved to reduce particles by 86% relative to natural dissipation within 15 minutes.

AtmosAir tested to a 125 Dust CADR and a 158 test CADR.



[AtmosAir Mold Clean Air Delivery Rate \(CADR\) Testing at ETL Labs.](#)

# Engineering Guidance – Third Party Articles and Mention

90% of top 30 MEP firms are specifying AtmosAir

<a href="#">HDR</a>	<a href="https://www.hdrinc.com/insights/ventilation-and-transmission-hvac-and-adapting-covid-19">https://www.hdrinc.com/insights/ventilation-and-transmission-hvac-and-adapting-covid-19</a>
<a href="#">Gensler</a>	<a href="#">Gensler Architects – AtmosAir 'How it Works' Video: https://www.youtube.com/watch?v=A-b7vDnFv6k</a>
<a href="#">NYU</a>	<a href="#">NYU Langone Medical Center: Cleaning the Air Using Bi Polar Ionization Technology - NYU Langone Medical Center - Dr. Philip Tierno Jr. (2017) (AtmosAir Mentioned)</a>
<a href="#">HGA</a>	<a href="#">HGA Architects and Engineers – Informative video on how bi-polar ionization and ultraviolet C work to disinfect the air. https://hga.com/engineering-i-v-air-disinfection/?fbclid=IwAR38BCCFnlUrNKZeif7aeS9rw8Sf5blKFDOHOBayhHEKpv1B2a9_aZna0</a>
<a href="#">Bala</a>	<a href="#">BALA Consulting Engineers - Consulting Specifying Engineer Magazine   Effective COVID-19 mitigation for HVAC systems: https://www.csemaq.com/articles/covid-19-and-the-impacts-to-the-workplace/?fbclid=IwAR2nw6R4_5BldBCY6gpPB7GLUWwYueATi2MsqGTiO422pOnCXswzIKMNBs https://www.bala.com/sites/default/files/2020-05/%20Bala_COVID-19-Webinar_0.pdf</a>
<a href="#">SSR</a>	<a href="#">Smith Seckman Reid Consulting Engineers - Consulting Specifying Engineer Magazine   Effective COVID-19 mitigation for HVAC systems: https://www.csemaq.com/articles/effective-covid-19-mitigation-for-hvac-systems/</a>
<a href="#">Terrapin Bright Green</a>	<a href="#">Terrapin Bright Green Whitepaper: The Nature of Air: Economics of Indoor Air Quality and Bio-Inspired Innovation by Bill Browning of Terrapin Bright Green (AtmosAir mentioned in whitepaper)</a>
<a href="#">Jacobs</a>	<a href="#">Jacobs Engineering   Jacobs Engineering accelerating retrofits of COVID-19 vaccine manufacturing facilities</a>
<a href="#">Gannet Fleming</a>	<a href="#">American Inst. of Architects, Gannet Fleming Consulting Engineers – Accelerating Recovery with Bi-Polar Ionization: https://aiapa.org/2020/05/31/accelerating-recovery-with-bipolar-ionization/</a>
<a href="#">CMTA</a>	<a href="#">CMTA Consulting Engineers and M+A Architects: https://www.ma-architects.com/news-insights/articles/take-a-deep-breath-we-ve-got-you-covered</a>
<a href="#">Cosentini</a>	<a href="#">Cosentini Associates AtmosAir Case Study: To Bring the Office Workforce Back Safely, the Science Backs Bi-polar Ionization - https://commercialobserver.com/2021/06/to-bring-the-office-workforce-back-safely-the-science-backs-bi-polar-ionization/</a>
<a href="#">Newman Consulting Group</a>	<a href="#">Newman Consulting Group - Three Coronavirus Prevention Techniques for Your Building - a Comparison: https://www.newmanconsultinggroup.us/green-building-blog/coronavirus-prevention-techniques</a>
<a href="#">JLL</a>	<a href="#">JLL: A Look Inside JLL's New WELL-Built Offices in New York City</a>
<a href="#">Hilton</a>	<a href="#">Hilton Engineering   AtmosAir Bi-Polar Ionization Case Study: Hilton Bulletin Featuring AtmosAir Testing Results by Hilton Engineering</a>
<a href="#">Facilities Guideline Institute</a>	<a href="#">Facilities Guidelines Institute - Guidance for Designing Healthcare Facilities</a>
<a href="#">SHP</a>	<a href="https://shp.com/2020/07/16/three-strategies-for-improving-infectious-disease-control-through-indoor-air-quality/">https://shp.com/2020/07/16/three-strategies-for-improving-infectious-disease-control-through-indoor-air-quality/</a>
<a href="#">Stantec</a>	<a href="https://www.stantec.com/en/ideas/engineering-our-return-to-the-workplace-after-covid-19">https://www.stantec.com/en/ideas/engineering-our-return-to-the-workplace-after-covid-19</a>
	<a href="https://www.stantec.com/content/dam/stantec/files/PDFAssets/2020/getting-back-to-business-guidebook-full.pdf">https://www.stantec.com/content/dam/stantec/files/PDFAssets/2020/getting-back-to-business-guidebook-full.pdf</a>
<a href="#">Arup</a>	<a href="https://www.csemaq.com/articles/how-covid-19-is-affecting-air-quality-smart-buildings/">https://www.csemaq.com/articles/how-covid-19-is-affecting-air-quality-smart-buildings/</a>
<a href="#">AEI</a>	<a href="https://www.csemaq.com/articles/what-hvac-changes-are-required-by-covid-19-learn-from-aei-experts/">https://www.csemaq.com/articles/what-hvac-changes-are-required-by-covid-19-learn-from-aei-experts/</a>
<a href="#">EXP</a>	<a href="https://www.71above.com/files/covid19/EXP-White-Paper-for-Restaurants.pdf">https://www.71above.com/files/covid19/EXP-White-Paper-for-Restaurants.pdf</a>
<a href="#">Henderson</a>	<a href="https://www.hendersonengineers.com/insight_article/infection-control-technologies-for-building-design/">https://www.hendersonengineers.com/insight_article/infection-control-technologies-for-building-design/</a>
<a href="#">Peter Basso</a>	<a href="https://www.csemaq.com/articles/technology-drives-k-12-school-changes/">https://www.csemaq.com/articles/technology-drives-k-12-school-changes/</a>
<a href="#">Salas O'Brien</a>	<a href="https://www.csemaq.com/articles/technology-drives-k-12-school-changes/">https://www.csemaq.com/articles/technology-drives-k-12-school-changes/</a>
<a href="#">Gannet Fleming</a>	<a href="https://docs.acec.org/pub/742851FB-1866-DAAC-99FB-62FD239A2E61">https://docs.acec.org/pub/742851FB-1866-DAAC-99FB-62FD239A2E61</a>
<a href="#">Perkins and Will</a>	<a href="https://www.belmont-ma.gov/sites/g/files/vyhlif6831f/uploads/2020_0121_-_iaq_improvement_r1.pdf">https://www.belmont-ma.gov/sites/g/files/vyhlif6831f/uploads/2020_0121_-_iaq_improvement_r1.pdf</a>





# Intelligent Air Treatment | Advance Towards Net Zero

*Moving and Conditioning Air Is Typically 40-50% of Total Building Energy Use*

## ***The Built Environment***

The built environment generates nearly 50% of annual global CO2 emissions. Of those total emissions, building operations are responsible for 27%. Achieving zero emissions from the existing building stock will require leveraging innovative technology.

## ***Intelligent Air Treatment Decarbonization Strategy***

IoT technology and controls that measure and intelligently purify air can dynamically control ventilation systems to conserve energy and GHG emissions. DBD BPI will allow air handlers to be dynamically reduced to their optimal outside air position. DBD BPI creates significant improvement in filtration efficiency and air disinfection without pressure drop or the maintenance requirements of more restrictive filters. This energy savings strategy can result in 20-40% reduction in HVAC energy expenditures with a 4-8% reduction on a buildings utility bill. DBD will also extend life of HVAC filters and HVAC equipment while reducing chilled water consumption.

## ***ASHRAE 62.1 Compliant Technology***

DBD BPI is fully compliant to the ASHRAE 62.1 Indoor Air Quality Procedure. Advanced air cleaning enables using the IAQP to reduce ventilation while maintaining or improving indoor air quality. DBD intelligent air treatment and disinfection as a technology to remove contaminants of concern is an acceptable method to decrease airflow rates.

# Cost Savings, Energy, Sustainability

Airside efficiency is typically the largest untapped opportunity for building owners. AtmosAir is an ASHRAE 62.1 Compliant IAQ Technology



## AtmosAir Bi-polar Ionization:

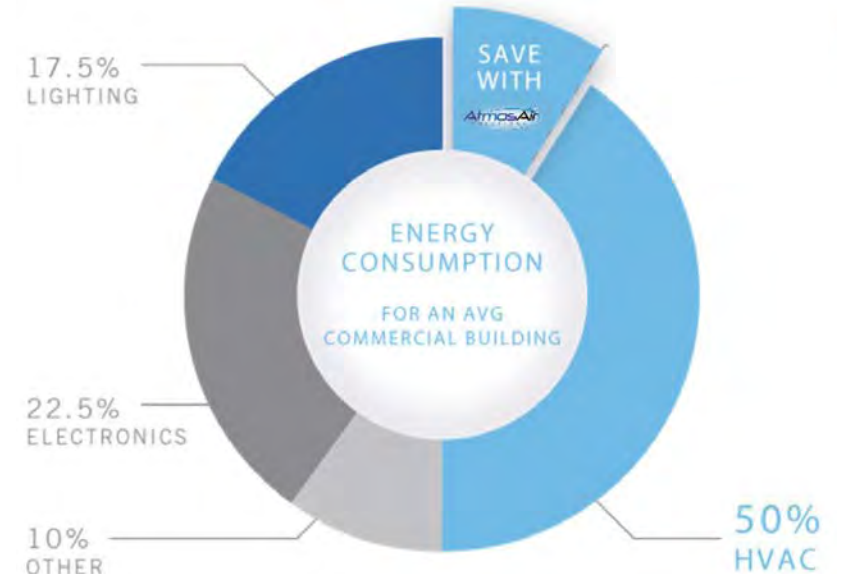
- Reduces Outside Air Requirements up to 50% within ASHRAE 62.1/IMC code
- Takes up little space within duct a duct or air handler.
- Has little to no pressure drop. Requires negligible power to operate.

## Capex Benefits:

- 15% Reduction in Equipment.
- Collateral Cost Savings in Installation, Piping, Electrical, Ductwork
- Potential 20-30% Reduction in HVAC Tonnage/Plant Sizes
- Less of an opportunity to bring in pollution from outside.

## Opex Benefits:

- 20-40% Reduction in HVAC Energy Expenditures
- 4-8% Reduction on ENTIRE utility bill.
- Pair with Cheaper Filters and Extend life of HVAC filters
- Extend life of HVAC equipment (sustainability)
- Reduced Water Consumption





**CLEANAIR**  
GROUP

**AtmosAir**  
SOLUTIONS

**BIOCLIMATIC**  
AIR SYSTEMS