
CIRCULUS
MIDDLE EAST
BEC
GROUP

Making an Impact Over Four Decades

Clean Air Group:

- Headquartered in Fairfield, CT, USA.
- Bioclimatic Air Systems Established in 1982 in NJ, USA
- AtmosAir brand Established in 2004
- 50M+ M^2 Installed Base
- Granted 10+ technology patents with 20+ pending patents.
- Offices in Arizona, London, Dubai, Shanghai

ASHRAE Participation & Activity

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.

Working with 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 2.9 | Ultraviolet Air and Surface Treatment
- **ASHRAE's Epidemic Task Force for Schools Recommended Bi-Polar Ionization Systems in July 2020.**

Tony Abate (CIE)

ASHRAE Committee Chair

Chief Technology Officer

CAG's Indoor Air Purification Solutions Portfolio

Established leader in solutions for healthier indoor air, our active air solutions work to measure and sanitize the air.

CAG products include revolutionary technology:

- *DBD Ionization*
- *Needlepoint Corona Discharge Ionization*
- *IoT based air quality monitoring,*
- *HE powered filtration*
- *Compact ceiling units*
- *Custom air handling and filtration assemblies*

CLEANAIR GROUP

AtmosAir SOLUTIONS

Leaders In Dielectric Barrier Discharge Ionization

BIOCLIMATIC AIR SYSTEMS®

The Choice in Integrated IAQ

CLEANAIR GROUP

Making an Impact over three decades

In the USA, 95% of the top 30 MEP firms by revenue have specified AtmosAir.

AtmosAir SOLUTIONS

125M+

Square Feet Installed

BIOCLIMATIC AIR SYSTEMS®

200M+

Square Feet Installed

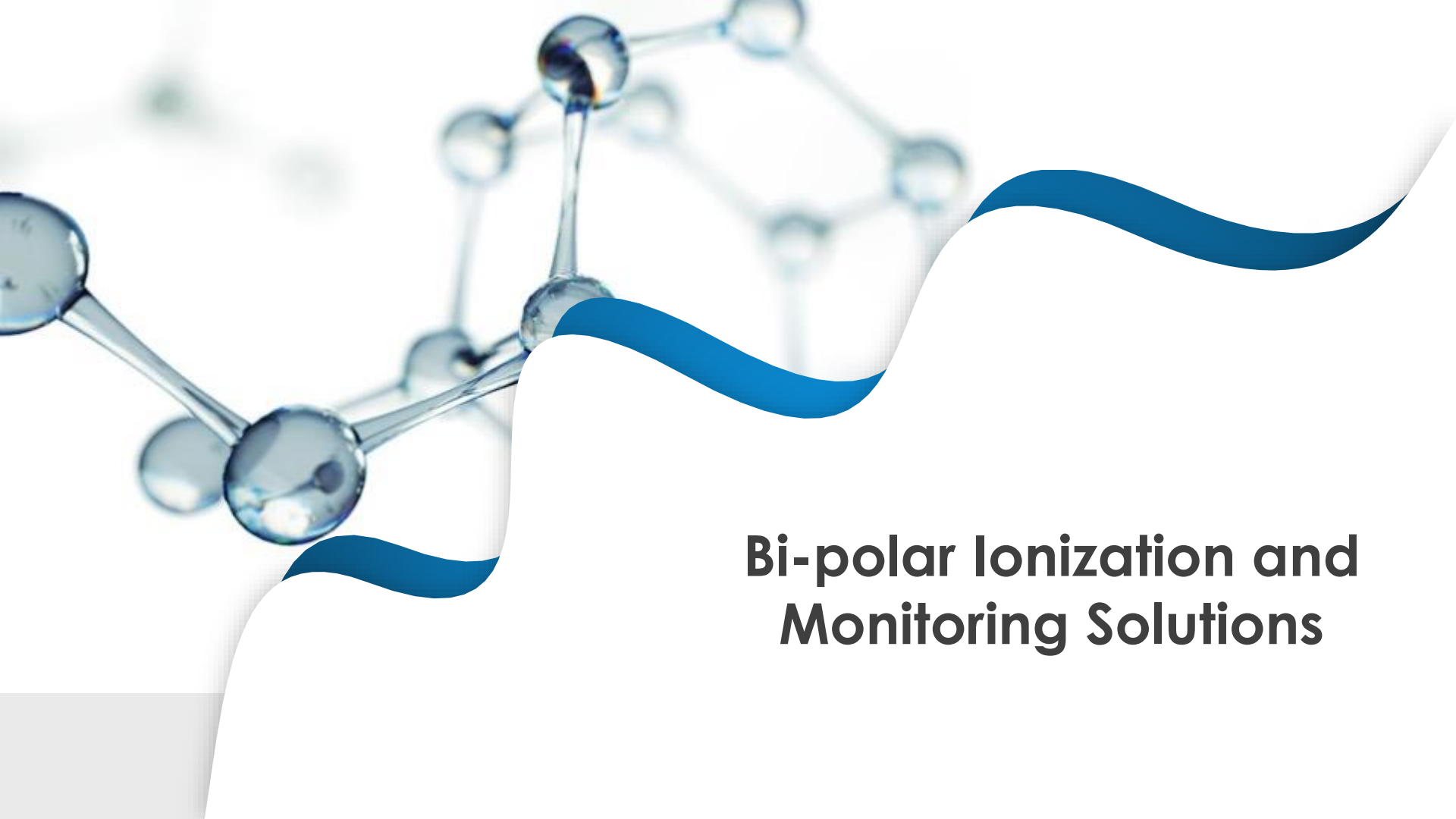
Design Community Allies

Architects and Mechanical Engineering Consultants Specifying Bi-Polar Ionization:

CLEANAIR GROUP

Experience in multiple markets

- Commercial Office Buildings
- Healthcare
- Convention Centers
- Grocery Stores
- Government
- Performing Arts
- Schools (K-12)
- Colleges & Universities
- Hospitality
- Sports
- Airports



Bi-polar Ionization and Monitoring Solutions

Not all bi-polar ionization is the same

There are multiple ways to generate the energy needed to create air ions.

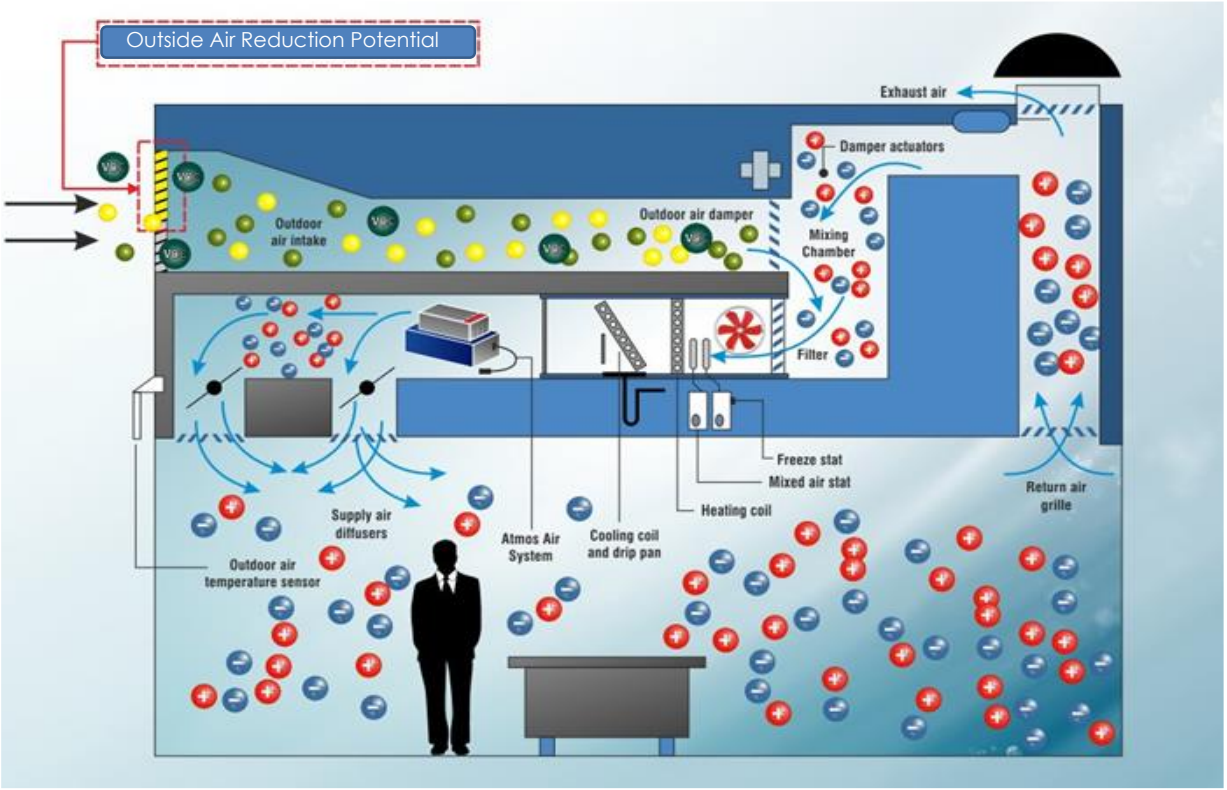
AtmosAir's technology uses dielectric barrier discharge (DBD)
Most Comprehensive & Powerful Form of BPI Air Purification
Occurs when voltage is applied to a cathode tube, where the inner metal is a cathode, and a stainless-steel outer screen is an anode. The voltage causes a non-thermal plasma discharge on the surface of the tube, which then produces ions in an alternating fashion, negative, positive, switching polarities 60 times per second.

Bioclimatic's ActiveOx technology uses a corona discharge
More Limited & Affordable Form of BPI Air Purification
Occurs when voltage is applied to rows of nickel coated steel pins recessed in electronic modules. Each module has two pins, one will produce a positive charge or form a positive ion and the other a negative charge or negative ion.

AtmosAir's DBD Bi-polar Ionization

- Purifies the air through **Agglomeration** of particles, **Oxidation** of VOC compounds and **Sterilization** which inactivates microorganisms including bacteria, viruses, and mold in the air and on surfaces.
- Uses an ionization energy of 12.60 eV. At an eV of 12.53 or higher, ozone that can be created is quickly converted back to neutral oxygen (**UL 2998 compliant**).
- The ability to ionize oxygen creates the superoxide anion. Superoxide is the most stable ion (lasting up to 300 seconds) and will create hydroxyl radicals on the surface of an organism such as bacteria, virus and molds. This inactivates the organism and renders it non-viable or disinfected.
- The ions are produced in an omni-directional flow around the entire surface of the ion tube alternately switching polarities 60 times per second. This causes them to scatter which results in superior ion persistence allowing them to saturate large spaces and airflows.
- Tested by independent laboratories to standardized ASTM, ANSI/ AHAM and ISO protocols and shown effective.
- Product has documented lifespan of 20+ years.

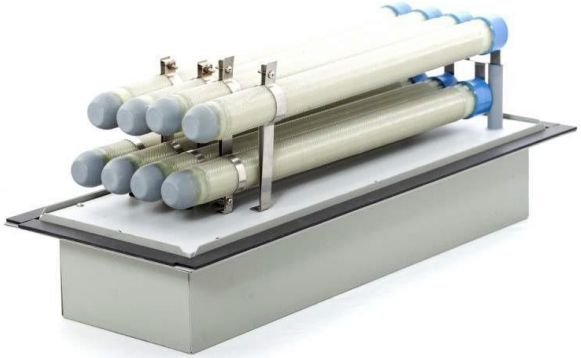
Bi-Polar Ionization (DBD) in an HVAC System



Large In-duct/In-AHU Systems

Electrical

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



Large In-Duct Systems		
	508FC	500FC
Number of Tubes	8	5
CFM	15,000	10,000

Small In-duct/In-AHU Systems

Electrical

Voltage……...110/250V
Frequency……50/60 hz
Power Consumption……..8 Watts
Current Draw……...370 mA
Internal Fuse……...500 mA
Field Electrical Connection……Junction Box or 110V Receptacle

Matterhorn 1000

Matterhorn 1002

Small In-Duct Systems			
	MH1000	MH1002	FC400
Number of Tubes	1	2	1
CFM	2,500	5,000	1,400

Small In-duct/In-FCU Systems

FC400/ FC400FM (24 VAC)

Electrical

Voltage……..**110/250V**
Frequency……**50/60 hz**
Power Consumption……..**8 Watts**
Current Draw……..**500 mA**
Internal Fuse……..**1.0 Amps**
Field Electrical Connection…….**Junction Box or 110V Receptacle**

FC100

Small In-Duct/In-FCU Systems			
	FC400	FC400FM	FC100
Number of Tubes	1	1	1
CFM	1400	1400	2000

AtmosAir Standalone Air Cleaners

Freestanding Unit

- 6-Stage Filtration System

Particle Filter (washable)
Carbon Filter
HEPA Filter
Antimicrobial Coating on HEPA
BPI
UV

- Up to 200CFM
- Contractor calibrates the ionization setting to attain ion level readings of between 350 and 1,500 negative ions/cubic cms in the space.

Freestanding Unit

- Up to 100 sqm
- Up to 700 CFM (4 ACH)
- BPI Technology built in
- HEPA H13 Filter
- Eliminates: MS2 (99.9%), H1N1 (99.9%), Coronavirus (99.9%), VOC’s (95.6%), E Coli (99.9%), Staphylococcus (99.9%)

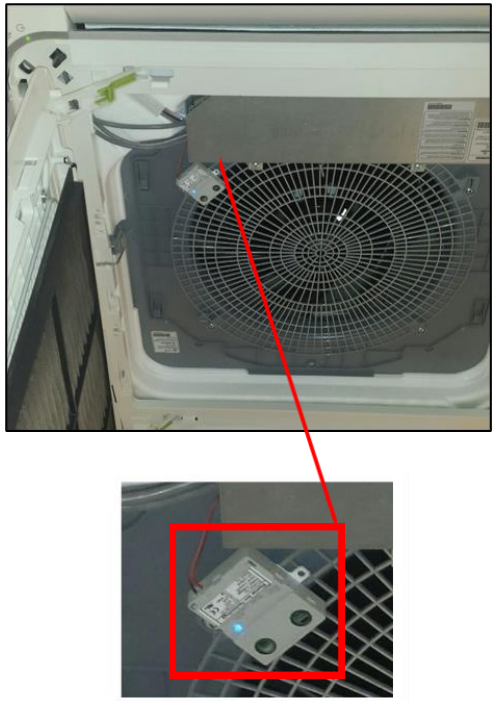
Needlepoint: ‘ActiveOx’ Product

- **Improved durability and reliability**: The latest enclosure design protect the internal components and the product design incorporates a robust product life-cycle.
- **Tested and Validated**: UL2998 verified zero ozone and UL 867 certified.
- **Power Supply Options**: range from 24V to 120/240V depending on product type
- **BMS flexibility** and **capability**: Communication module is separate for greater integration options.
- **Corrosion resistant**: The emitters are specifically made from a corrosion resistant material that will last longer than carbon fiber brushes.
- **Recessed emitters**: The HVAC airflow will not directly impinge dirt and debris on the emitters causing less maintenance and fouling of the emitter. The recessed emitters prevent damage from inadvertent contact during service, a risk with exposed brushes or pins.
- **Options**: Ion detector is available when specified or requested

Needlepoint: ‘ActiveOx’ Product

Modular product design:

- **Rail mount:** for larger applications
- **Duct mount** for compact installations
- **Fan coil** for smaller CFM and VRF applications
- Optional: Continuous Ion Monitoring



Ceiling VRF

Rail-mount

Duct-mount

AtmosAir & ActiveOx are Certified – Ozone Free

UL2998 Certified

VERIFIED
ZERO OZONE

Certificate Appendix

ATMOSAIR

Certificate Number: 104404620GRR-001

Product Category	Air Cleaner
Model Name(s)	M880, M882, M1000, M1002
Product Restrictions	None

This Certificate is for the exclusive use of Intertek's client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Certificate. Only the Client is authorized to permit copying or distribution of this Certificate. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test/inspection results referenced in this Certificate are relevant only to the sample tested/inspected. This Certificate by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

Intertek Testing Services NA, Inc. 29 September 2020 2 of 2

UL867 and UL867A Certified

VERIFIED
ZERO OZONE

Certificate Appendix

CLEAN AIR GROUP

Certificate Number: ZOZ-90111-2022a

Product Category	Needlepoint Ionization Unit
Model Name(s)	Active-Ox
Product Restrictions	Certification only applies to model with all of the below characteristics: - 100/240 VAC, 50/60 Hz, 0.5 W.

This Certificate is for the exclusive use of Intertek's client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Certificate. Only the Client is authorized to permit copying or distribution of this Certificate. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test/inspection results referenced in this Certificate are relevant only to the sample tested/inspected. This Certificate by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

Intertek Testing Services NA, Inc. 29 September 2020 2 of 2

Monitoring Solutions

Real-time Indoor Air Quality Monitoring Options

AtmosAware

AtmosAware Mini

AtmosSmart

Indoor Air Quality Monitoring

Measures and validates indoor air quality in real time.

Measures:

- Carbon Dioxide (CO2)
- Particulate Matter (PM2.5)
- Total Volatile Organic Compounds (TVOC)
- Temperature
- Relative Humidity
- Bacnet compatible

Checks current measurements & analyzes historical levels to detect important changes. Provides data reports on air quality.

Indoor Air Quality Monitoring

Measures and validates indoor air quality in real time.

Same as AtmosAware - without a screen.

Extra Features:

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

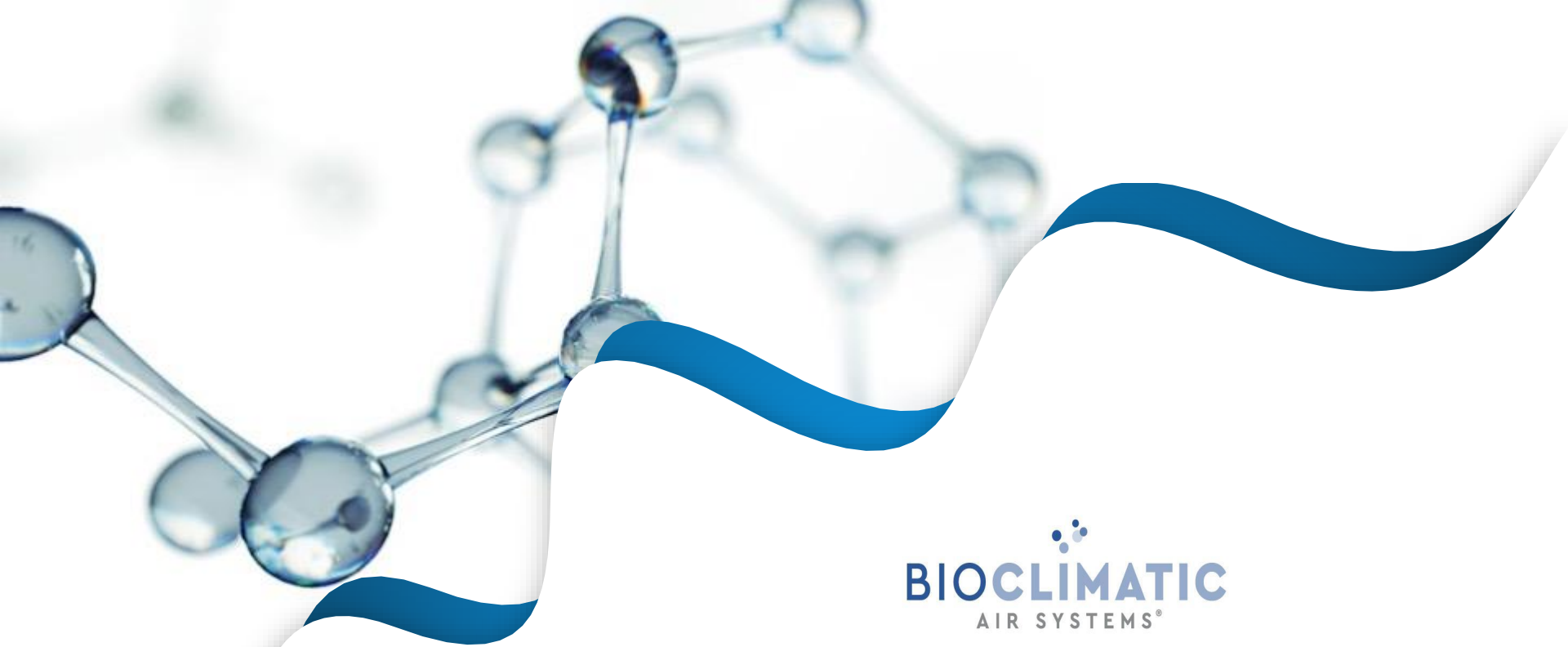
Checks current measurements & analyzes historical levels to detect important changes. Provides data reports on air quality

IoT Sensor

- Monitors 10 parameters of air quality plus outdoor AQI
- RESET Certified
- Cellular Gateway for independent communication
- No Wi-Fi or ethernet needed
- BMS compatible via BACNET; BTL Certified
- Fully remotely programable
- Actively controls BPI levels to conform with changes in air quality (patent pending)
- Field serviceable to replace individual sensor cards or sensor bank tray

IoT Platform

- All-in-one equipment installation monitoring maintenance and service device
- Users 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 alter and exports data reports



BIOCLIMATIC
AIR SYSTEMS®

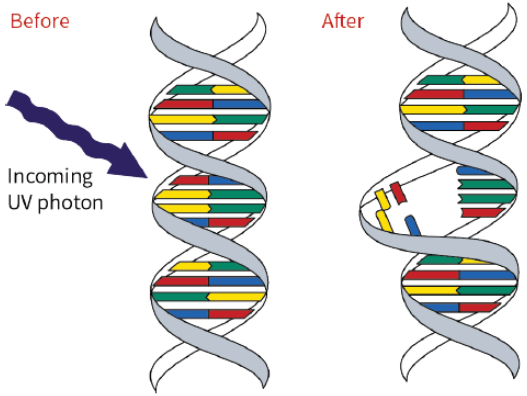
Product Range

Particulate Filtration

- Conventional passive filters – industry standard e.g., panel, pleated, bag, cartridge
- Historically used in HVAC to keep system clean, *not* for IAQ
- Known pressure drop and energy costs
- Efficiencies range up to MERV 16 (ASHRAE 52.2) – evolution in the industry - effective for trapping bacteria and some virus, and to serve as HEPA prefiltration
- HEPA Filters

UV Irradiation

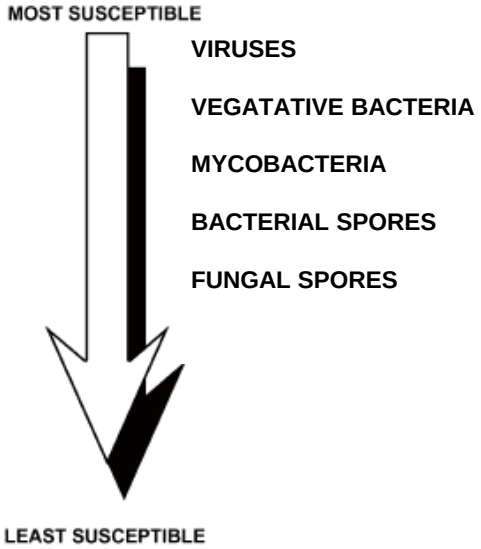
- Ultraviolet irradiation, a.k.a. germicidal UV (UVGI), UV(C) wavelength deactivates pathogens. Functions by preventing the unzipping of the nucleic acids that would allow replication.
- Can be installed in the AHU, duct, or be provided in a stand-alone packaged solution.
- High single pass efficacy available, when that is a requirement.



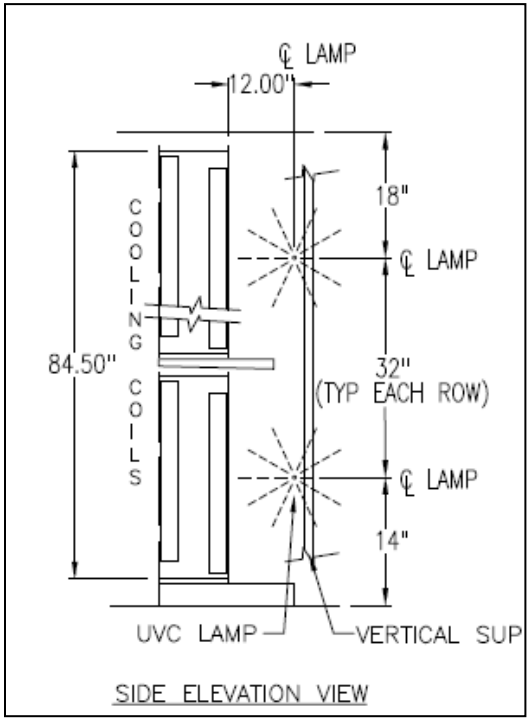
UV Irradiation

Key Parameters for Optimizing Performance:

1. **Intensity of the light** – lamp output, density of lamps, reflectivity of the enclosure.
2. **Duration of exposure** – lower air velocity (not effective at >1000 fpm), longer straight run of duct
3. **Air Temperature** – RA (warmer) more effective than SA (cooler)
4. **Type of pathogen**



UVGI - Coil Maintenance



Standard output lamps for stationary fungal spores (“coil maintenance”)

Polarized Hi-E Particle Filtration (“Biotronic”)

Biotronic powered filter:

- High-performance contaminant removal, low pressure drop, with an extended maintenance cycle.
- DC voltage is used to create an electrostatic field inside a media pad.
- The field polarizes the media fibers and particles in the air. This attracts the particles to the media.
- Smaller particles are captured

Polarized Hi-E Particle Filtration (“Biotronic”)

2x2 or 3x3 nominal sizes, rectangular, too (but not curved surfaces).

or duct mounted (to provide what is not supplied by VRF manufacturer)

Photo Catalytic Oxidation (PCO)

Very effective solution for filtering specific contaminants. Utilizes UV(C) irradiating a TiO_2 catalyst to oxidize & deactivate pathogens as well as reduce some VOCs.

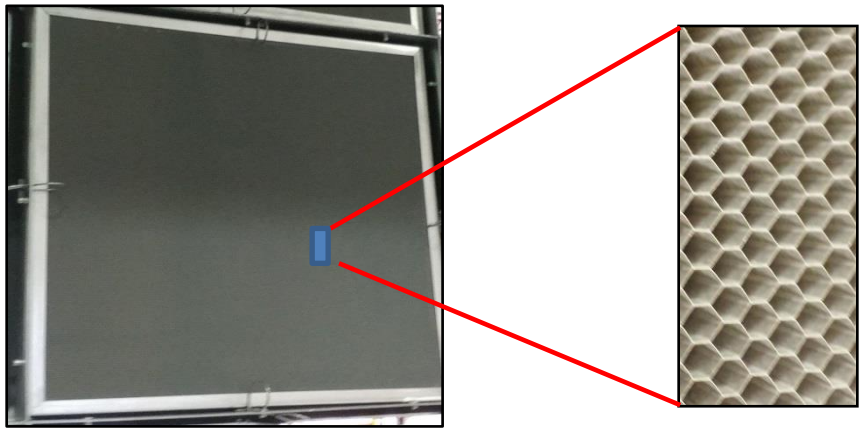
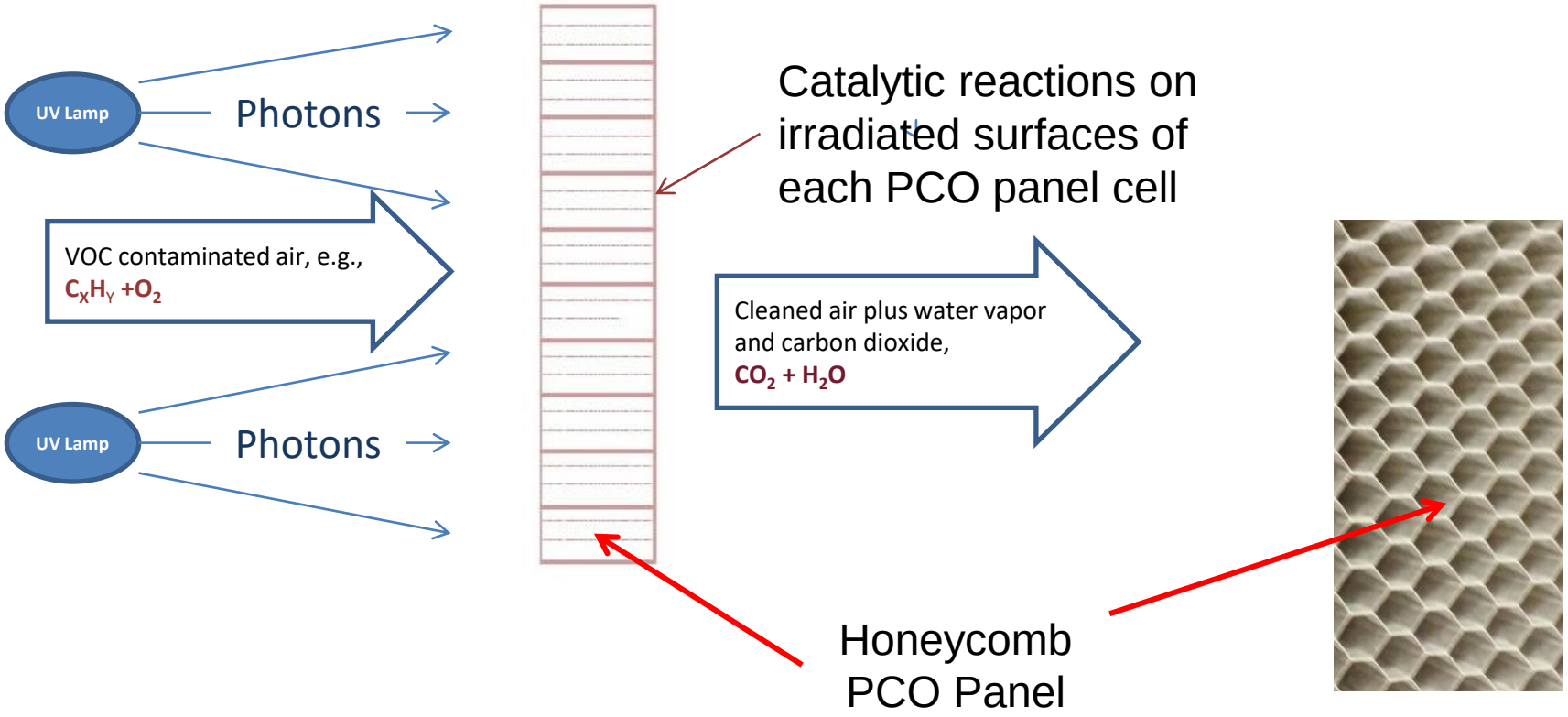


Photo Catalytic Oxidation (PCO)



Chemical Media

The “gold standard” for removal of *gaseous* pollutants. Typically applied for specific chemical removal or more demanding air purification requirements. The contaminant is absorbed, adsorbed, or neutralized by media for the elimination of odors, removal of toxic gases, or prevention of corrosion.

- Control odors & gas phase contaminants
- Control of intake pollutants and exhaust emissions
- High one-pass efficiency: to over 99% if designed accordingly
- Provides predictable and reliable performance

Chemical Media

Examples:

- Intake of contaminated outdoor air, or objectionable exhaust
- Food odors
- Paints/solvents/glue
- Laser/3D printer chemicals
- Smoking (not the particulates but the 100s of gas compounds produced by smoking tobacco products)
- Gymnasium/locker room
- Grow room odor
- Corrosive environments

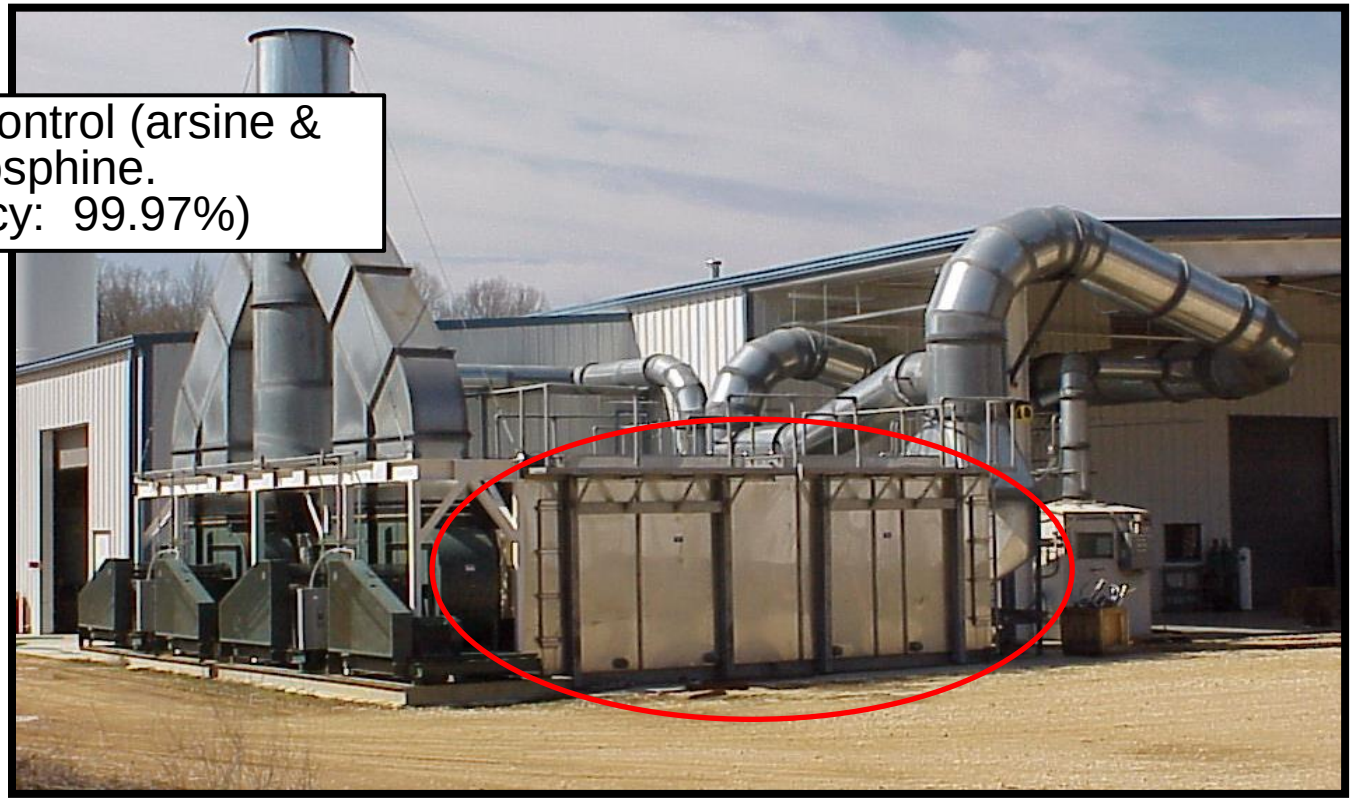
Where there is a strong challenge and need for substantial reduction with a single pass

Chemical Media

Modules or trays

Chemical Media

Toxic gas control (arsine & phosphine.
Efficiency: 99.97%)



Chemical Media

Vertical units (water overflow treatment facility)

Providing ultimate flexibility, we can package solutions as standalone or integrated into existing systems

- Accessible Housing modules mounted to AHU or duct inline
- Compact Ceiling Units (MC Series)
- Built to order air purification systems featuring an array of technologies and features including:
  - BPI
  - Particulate filtration
  - UVGI / UVC
  - Chem media
  - PCO
  - BMS integration

Bioclimatic Applied Engineered Solutions

- Airborne viruses or controlling offensive odors, we have the answers and solutions for most air purification problems

- We help identify root cause of source and work with stakeholders to develop a practical and durable solution within budget

- Our experts work to select the media or filtration level appropriate for the application while remaining flexible on how to package the ultimate solution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