



See Air
Differently



National Partner

4+ Decades of Experience

*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**.*

*90% of the top 30 MEP consultants have specified **AtmosAir**.*



120M+

SQUARE FT INSTALLED



AtmosAir Selected World Class Customers in Core Market Verticals



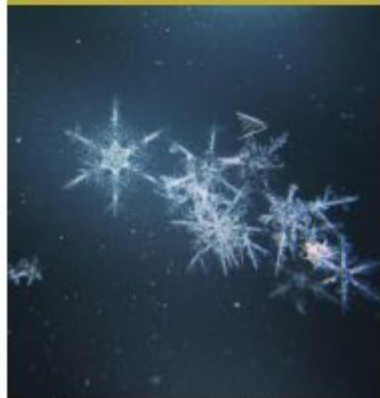
How It Works



- AtmosAir leverages a patented and proprietary Dielectric Barrier Discharge Bi-Polar Ionization technology.
- In pristine environments there are naturally higher ion levels. AtmosAir's goal is to increase indoor Bi-polar ion concentration by 3-4x ambient (500-1500 ions/cm³) replicating ion rates found in natural levels.
- AtmosAir Ion Lifespan: 300 seconds
- Composite AtmosAir tubes leverage nonthermal plasmas generated by Dielectric Barrier Discharge process.

DBD BPI Benefits

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.

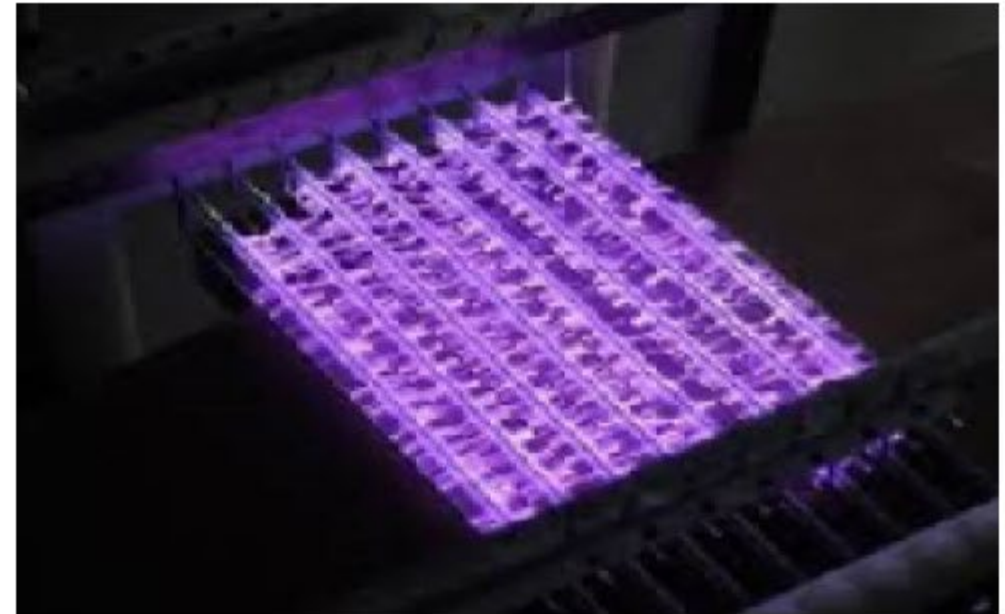
Image Credit: Eric Erbe, USDA / Wikimedia commons

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



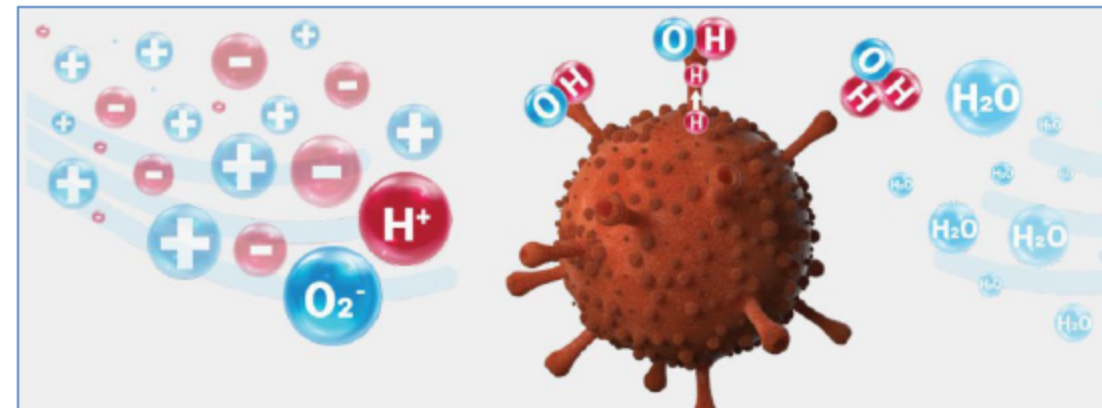
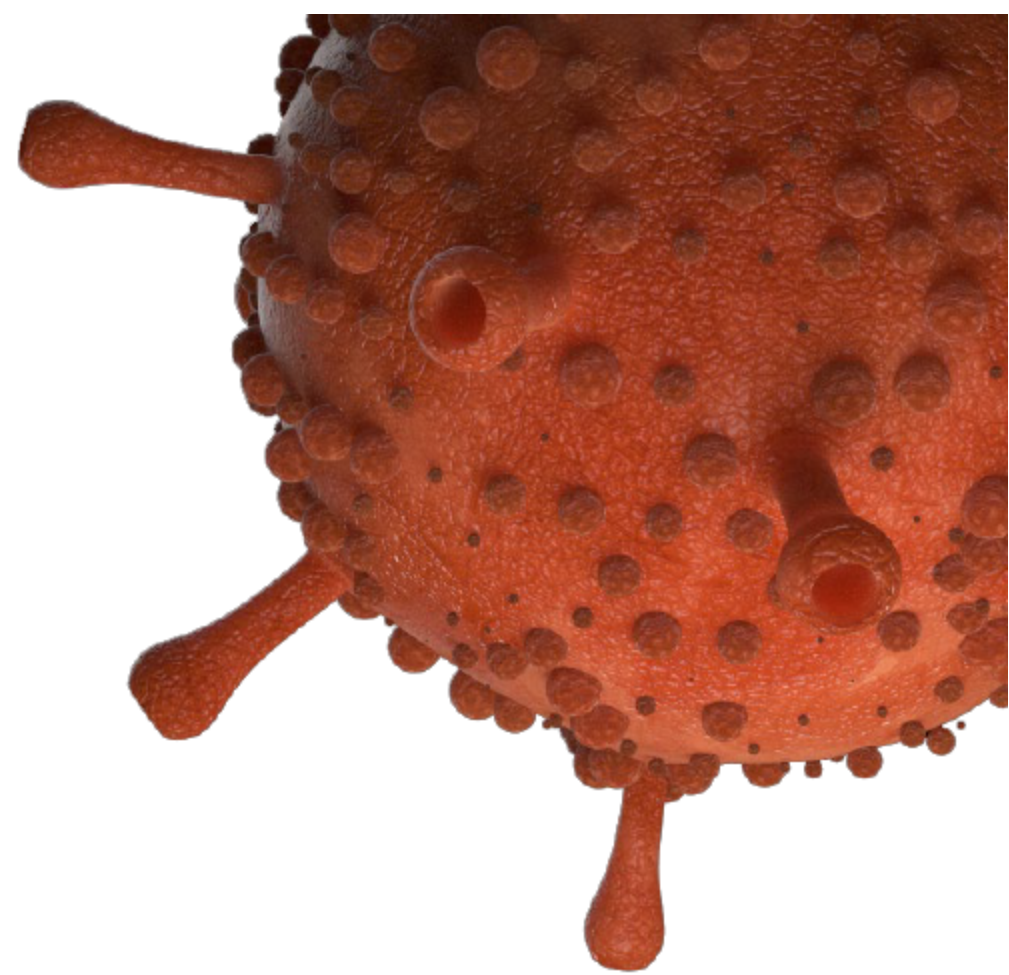
1. Dielectric Barrier Discharge process leverages up to 75,000 ion emitters per typical Composite tube.
2. Ions generated using voltage and AC at very low amperage.
3. Verified Ozone Free Technology – UL 2998/UL867A Certified.

How It Works

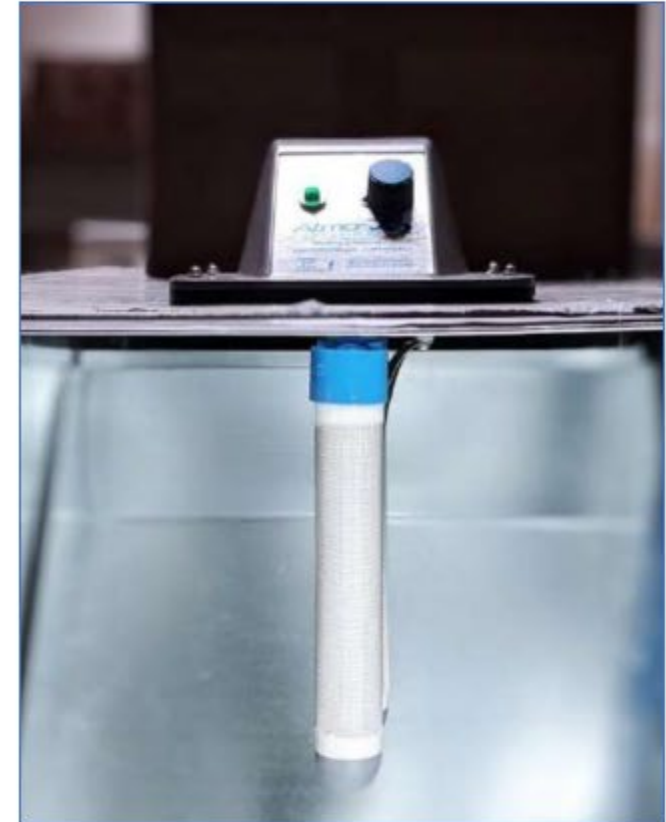
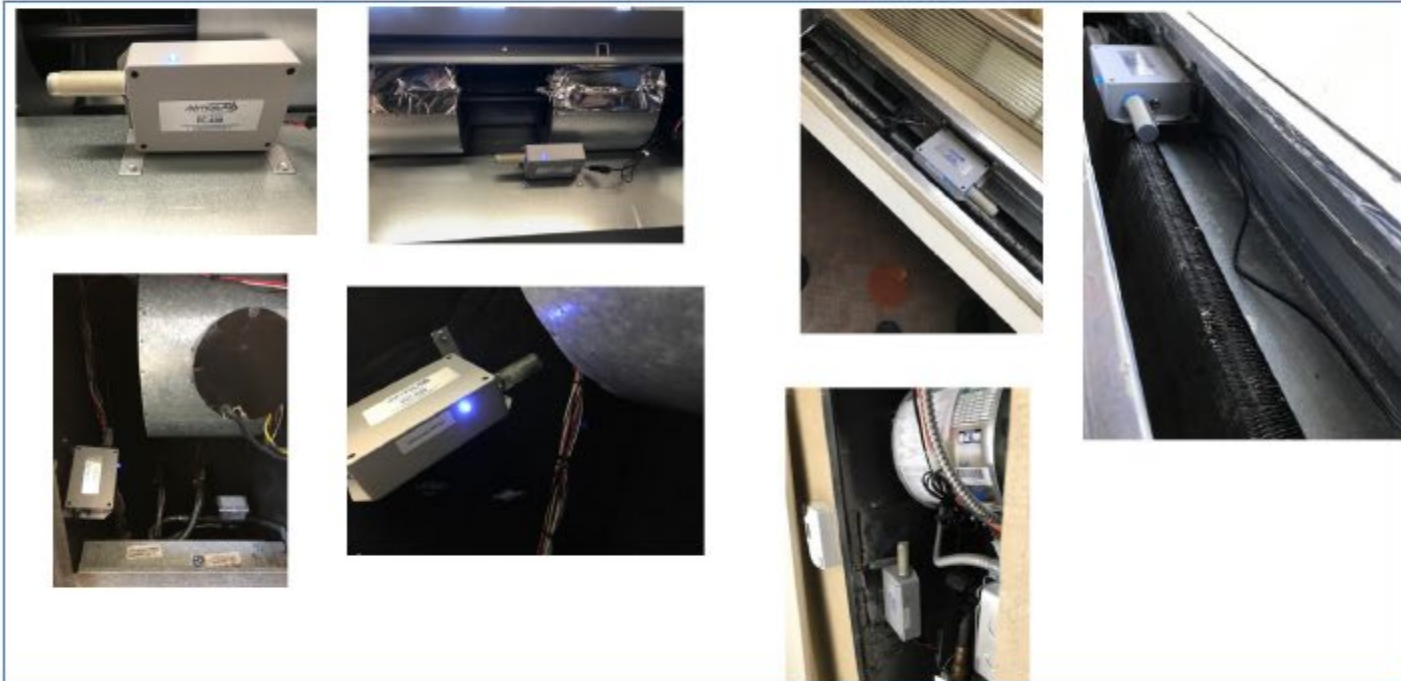
*AtmosAir BPI breaks down the structure of known pathogens, **such as coronaviruses, molds, bacteria, and other complex contaminants.***

- Positive (+) and Negative (-) ions are introduced into the air via the AtmosAir system.
- Negative (O_2^-) ions surround the hemagglutinin (surface proteins that form on organisms and trigger infections) and change into highly reactive OH groups called hydroxyls ($\bullet OH$)
- Hydroxyls steal hydrogen from the hemagglutinin, and return to the air as water, leaving holes in the membrane.
- Ions destroy the virus surface structure, for example its envelopes and spikes, on a molecular level. As a result, the virus cannot infect even if it enters the body.

Source: Dr. John Oxford, Professor, Institute of Cell and Molecular Science at St. Bartholomew's and The Royal London Hospital. Dr. Oxford is a world respected authority on virology.



Installations – FCUs



Published Data – Coronavirus, Mold Spores, Ultrafine Particulate

Study Report – Coronavirus 229E



Test Report | Microchem Laboratory

Test Results at 30 minutes

Study Title

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

Standardized Test Method

ASTM E1053

Maximum Ionization Rate

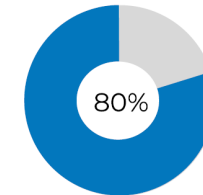
1,500 ions cm/3

Test Result

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

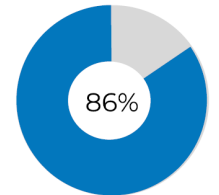
		Test Results Replicate 1 30 minutes	Test Results Replicate 2 30 minutes	Test Results Replicate 3 30 minutes
Cell Control		0 0 0 0	0 0 0 0	0 0 0 0
Dilution	10⁻¹	0 0 0 +	0 0 0 +	0 0 0 0
	10⁻²	0 0 0 0	0 0 0 0	0 0 0 0
	10⁻³	0 0 0 0	0 0 0 0	0 0 0 0
	10⁻⁴	0 0 0 0	0 0 0 0	0 0 0 0
	10⁻⁵	0 0 0 0	0 0 0 0	0 0 0 0
TCID₅₀ per 0.1 ml		0.75 Log ₁₀	0.75 Log ₁₀	≤0.50 Log ₁₀
TCID₅₀ per Carrier		1.05 Log ₁₀	1.05 Log ₁₀	≤0.80 Log ₁₀
Average Log₁₀ Reduction		2.78 Log ₁₀		
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.



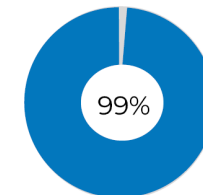
Reduction in VOC's

Source: Univ. of Syracuse Testing 2019

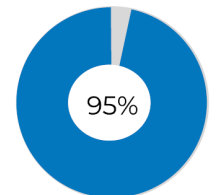


Reduction in PMO.3

Source: ETL CADR Testing



Reduction in Staph & MRSA



Reduction in MS2 Bacteriophage

Peer Reviewed and Published Academic Research Supports DBD BPI

- a. BPI systems leveraging nonthermal plasmas generated by dielectric-barrier discharge technology, as an air disinfection strategy to control viruses, airborne microbes, and particles, have been **reviewed positively in over 30 peer reviewed studies in the past twenty years**. Many of these studies have been published in the most reputable academic journals.
- b. There is little to no published or peer reviewed research on needlepoint ionization. Needlepoint ionization has yet to have any academic institutions or journals publish third-party findings or case studies.
- c. Data on Needlepoint ionization is typically coming from a manufacturer claiming product effectiveness.
- d. In many controlled environments as well as large scale commercial air distribution systems, AtmosAir Solutions has been thoroughly tested and vetted many different needlepoint ionization systems.

Peer reviewed and published studies that support air ionization technologies to reduce airborne viruses, microbes, and particles.

<p>Limiting air effects influenza virus</p> <p>Peer Review Publication: <i>Journal of Electrostatics</i>, 2017. https://www.scribd.com/document/342520484</p> <p>Peer Review Publication: Nature</p> <p>This study proved that an ionization system was more effective than the ionization system in the presence of an ionization system. This study also showed that ions produced by the ionization system as well as those in the presence of an ionization system.</p>	<p>Effect of negative air ions on the potential for bacterial contamination of plastic medical equipment.</p> <p>Peer Review Publication: BMC Infectious Diseases, 2014. https://pubmed.ncbi.nlm.nih.gov/26144999/</p> <p>This study proved that ionization systems can be used to reduce bacterial contamination of plastic medical equipment.</p>
<p>Evaluation of ionic air purifiers</p> <p>Peer Review Publication: <i>Indoor Air</i>, 2011.</p> <p>This study proved that air ionization technologies are effective in reducing indoor air particulate matter and allergens.</p>	<p>Effectiveness of plasma-generated ions on various microorganisms.</p> <p>Peer Review Publication: <i>Medical & Biological Engineering & Computing</i>, 2005. https://pubmed.ncbi.nlm.nih.gov/15949369/</p> <p>Air purification by plasma-generated ions relies on a relatively simple technology producing positive and negative ions. Physiological tests have shown strong evidence of lethal effects of ions on various microorganisms. The aim was thus to test the bactericidal efficacy of ionization technology on common indoor microorganisms and to explore possible mechanisms of action.</p>
<p>Removal of Viable Bacterial Particles with Air Ionization</p> <p>Peer Review Publication: <i>Indoor Air</i>, 2001.</p> <p>Griffith University in Australia conducted research that demonstrated that air ionization technologies can effectively reduce viable bacterial particles in indoor air.</p>	<p>Effectiveness of negative air ionization for removing allergens from the air.</p> <p>Peer Review Publication: <i>The Canadian Society for Clinical Investigation</i>, 2014. https://www.researchgate.net/publication/266120834</p> <p>This study aimed to investigate the effectiveness of an air ionizer in removing allergens from the air. The study found that air ionization technologies are effective in reducing allergen concentrations in indoor air.</p>
<p>On the Ionization of Air for Reducing Contaminants with Nonthermal Plasma</p> <p>Peer Review Publication: <i>IEEE</i>, 2014.</p> <p>Dr. Shree Damrath, PhD, and Prof. M. S. Lee, PhD, are the lead authors of this study.</p>	<p>Electrostatics in the environment: How they may affect human health.</p> <p>Peer Review Publication: <i>Journal of Physics</i>, 2007. https://pubmed.ncbi.nlm.nih.gov/17215513/</p> <p>Electrostatics in the environment can have various effects on human health, including influencing the behavior of airborne particles and microorganisms.</p>
<p>Air ionization and colonization/infection</p> <p>Peer Review Publication: <i>Intensive Care Medicine</i>, 2018.</p> <p>This study explored the relationship between air ionization and the colonization of surfaces by microorganisms.</p>	<p>Upper-room ultraviolet light and negative air ionization to prevent tuberculosis transmission.</p> <p>Peer Review Publication: <i>PLoS Medicine</i>, 2009. https://www.researchgate.net/publication/45280459</p> <p>Upper-room UV lights and negative air ionization each prevented most airborne TB transmission detectable by guinea pig air sampling.</p>
<p>Experimental evaluation of positive air ionizers</p> <p>Peer Review Publication: <i>Building and Environment</i>, 2014.</p> <p>This study evaluated the performance of positive air ionizers in reducing indoor air pollution and improving air quality.</p>	<p>Plasma Cluster Ions Reduce the IgE Binding Capacity of House Dust Mite Allergens under a Simulated Indoor Environmental Condition.</p> <p>Peer Review Publication: <i>International Archives of Allergy and Immunology</i>, 2017. https://pubmed.ncbi.nlm.nih.gov/2848139/</p> <p>The IgE-binding capacity of the HDM allergens was significantly impaired after ionization compared to that after sham treatment under both experimental and simulated environmental conditions. The ELISA results demonstrated that the IgE-binding capacities of HDM allergens after ionization treatment showed 88 and 14% reductions compared to those after sham treatment under the experimental and simulated environmental conditions, respectively. Ionization may have the capacity to impair the IgE-binding capacity of airborne HDM allergens in a simulated indoor environmental condition.</p>
<p>The effect of surface charges on the adsorption of bacteria</p> <p>Peer Review Publication: <i>Journal of Electrostatics</i>, 2010.</p> <p>This study investigated how surface charges influence the adsorption of bacteria onto various materials.</p>	<p>Effect of a commercial air ionizer on dust mite allergens.</p> <p>Peer Review Publication: <i>Asian Pacific Journal of Tropical Biomedicine</i>, 2011. https://www.asia-pacific-journal.com/article.php?id=JTB-11013844</p> <p>This study demonstrated the increasing mite mortalities with air ionization and its use to reduce mite populations in indoor environments.</p>
<p>Negative Air Ions and Their Effects on Human Health</p> <p>Peer Review Publication: <i>International Journal of Environmental Research and Public Health</i>, 2018.</p> <p>This review summarizes the current scientific understanding of the health impacts of negative air ions.</p>	<p>Upper-room ultraviolet light and negative air ionization for air disinfection.</p> <p>Peer Review Publication: <i>PLoS Medicine</i>, 2009. https://doi.org/10.1371/journal.pmed.0060042</p> <p>This study proved that using an airborne infection model of Upper-room UV lights and negative air ionization each prevented most airborne TB transmission detectable by guinea pig air sampling.</p>



Solution Agnostic Leadership

Clean Air Group manufactures many IAQ solutions including Dielectric Barrier (DBD) Bi-Polar Ionization Systems and Needlepoint Ionization Systems

Clean Air Group has been manufacturing air ionization systems, and other IAQ control systems, for over 30 years.

- **Solution agnostic leadership in IAQ industry.**
- **BPI solutions for ALL air distribution and air handling configurations.**

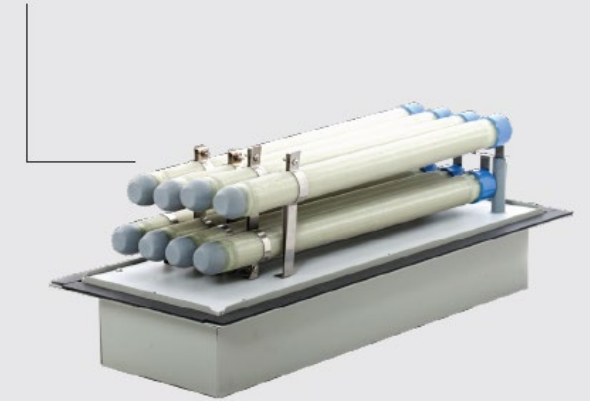
Robust Product Design

AtmosAir systems are built to be robust and withstand harsh commercial environments.

- An AtmosAir FC tube uses a 21-inch tube (electrode) to treat approximately 2,000 square feet or 2,000 CFM.
- A most critical difference with AtmosAir's technology is that the electrode is inside of the AtmosAir ion tube. The electrode/cathode is not exposed to ambient conditions.
- AtmosAir BPI Systems are UL2998 Compliant or Verified Zero Ozone Technology.
- The design of the AtmosAir tube prevents the electrode/cathode from acting as an electrostatic precipitator. An exposed design will attract particles to the 'needlepoints' wearing them out over time.
- AtmosAir's unexposed electrode design prevents oxidation from occurring as quickly as an exposed design. As electrodes/ion emitters are exposed to ambient conditions, while being subjected to relatively high voltage, they oxidize and eventually wear out. Very similar to how a spark plug operates.
- An AtmosAir 508FC has (8) 21" tubes per system. Each tube has 75,000 ion discharge sites. A 45,000 CFM air handler would require (24) 21" tubes or 1,800,000 ion discharge sites.

AtmosAir 508FC

Each AtmosAir 508FC system has (8) 21" AtmosAir tubes. Each tube has a 21" electrode in the core of the tube. The electrode is not exposed to ambient conditions.

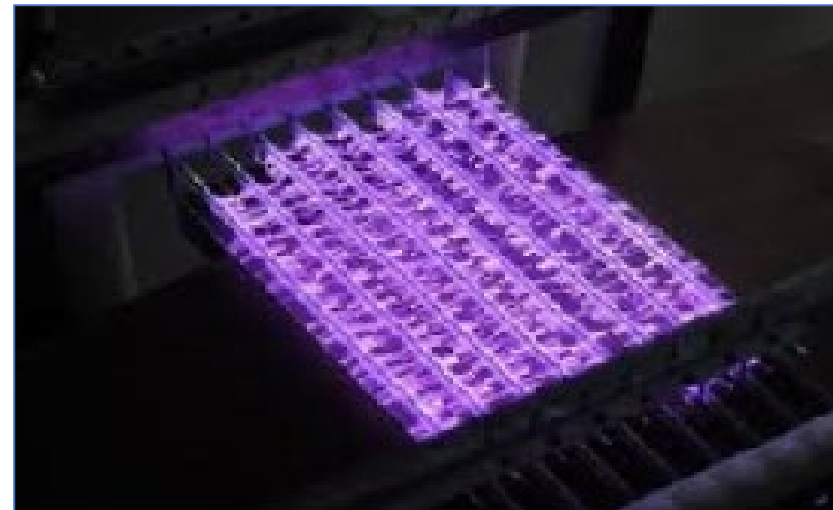


AtmosAir Dielectric Barrier Discharge BPI generates precisely controlled Nonthermal Plasma (NTP). Needlepoint Ionization does not.

- University of Michigan has proven that Non-Thermal Plasma (Cold plasma) can kill 99.9% of airborne viruses. <https://news.umich.edu/cold-plasma-can-kill-99-9-of-airborne-viruses-u-m-study-shows/>
- Non-Thermal Plasma is very similar to a flame it just does not have the high temperature.
- Needlepoint ionization does not create Nonthermal Plasma. It leverages a corona discharge or 'spark' effect to generate reactive charged species.



University of Michigan NTP Study



Example Dielectric Barrier Nonthermal Plasma Discharge

Real-Time Indoor Air Quality Measurement, Verification and Controls

AtmosAir has been awarded for being an intelligent air purification system with demand-controlled capabilities (AtmosSmart, AtmosAware).

- AtmosSmart is an integrated in duct air monitoring system, that connects to the AtmosAir bi-polar ion unit and will adjust Bi-Polar Ion levels based on feedback from the IAQ readings it is measuring. This is to provide optimal ion levels.
- AtmosSmart and AtmosAware measures and controls around 8 parameters of IAQ: TVOC, particulate matter (PM2.5), formaldehyde, ozone, carbon dioxide, carbon monoxide, relative humidity and temperature.
- All AtmosAir systems have various control settings they can be run at. All AtmosAir systems have various BMS integration controls including continuous Indoor Air Quality monitoring.
- Needlepoint ionization manufacturers typically do very little when it comes to commissioning, measurement, and verification of actual air cleaning performance.
- Needlepoint systems can not be adjusted. They run on (1) ionization setting out of the box.





AtmosAir with an Impact

•Real-World Performance Test data

- Over 100 proof of concept projects with testing and third-party data.
- Proof of concepts accomplished across major verticals. Everything from a 1-year pilot at the Staples Center to testing at many hospitals.

•AtmosAir Laboratory Test Data

- Microchem Laboratory, a leading lab for testing EPA- and FDA-approved products, tested AtmosAir's virucidal efficacy on Human Coronavirus, Strain 229E. The test, completed to a standardized ASTM E1053 protocol, demonstrated greater than 99.9% efficacy in reducing the presence of the virus under simulated real-world conditions.
- AtmosAir has performance data vs. influenza, MS2, MRSA, Staph.

•Peer-Reviewed Studies

- There are over 30-peer reviewed studies that support our technology, air ionization with nonthermal plasmas generated by dielectric-barrier discharge.
- Strong reference list of published studies in respected academic journals.

•IAQ Controls and Monitoring.

- Thanks to public grants and many years of work and dedication, AtmosSmart is the only air treatment solution with intelligent controls and continuous measurement and verification.

•Whitepapers/Presentations by Respected Third Parties and Consulting Engineering Firms

- 90% of the top 30 MEP consultants by revenue are specifying AtmosAir in new designs.

•AtmosAir Case studies, Testimonials, Videos

- Portfolio adoption with many high profile and Fortune 500 companies.
- Filmed and published case studies.
- AtmosAir Intro video: <https://www.youtube.com/watch?v=SlSYA00jCJU>