



AtmosAir Bi Polar Ionization Air Purification Technology

AtmosAir INTRODUCTION

New technologies are constantly being introduced to our marketplace. AtmosAir Solutions, is the leading manufacturer of Bi-Polar Ionization (BPI) systems for Indoor Air Purification.



AtmosAir 508FC

AtmosAir BPI options will save businesses money and at the same time protect a major investment, the HVAC equipment.

BACKGROUND

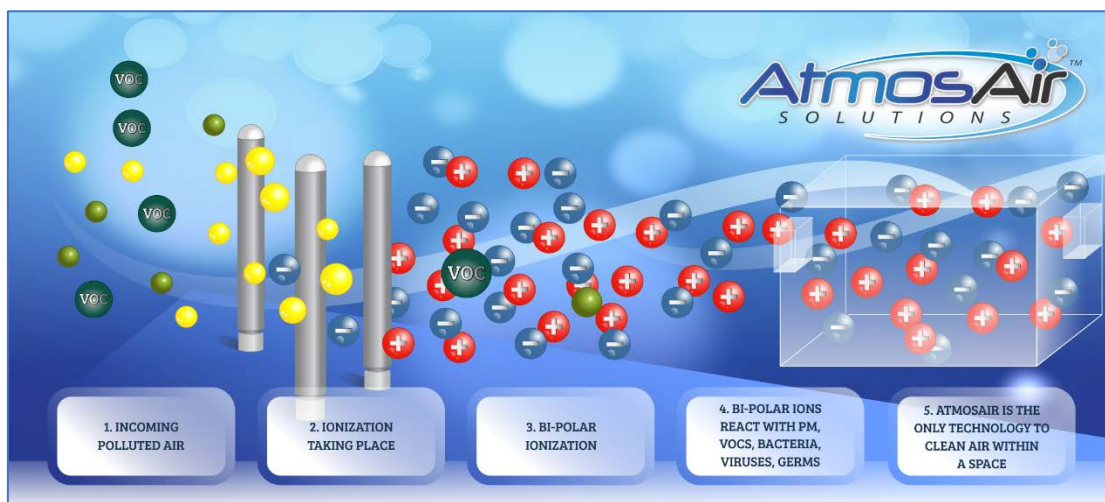
One of the fastest evolving technologies to be introduced into the HVAC industry in the past 15 years is Bi Polar Ionization (BPI). Building design and construction have been impacted by ever evolving ASHRAE standards, and owners are becoming more and more focused on not

only heating/cooling/moving so much air, but also making sure the HVAC design provided is energy efficient. Along with energy efficiency, many owners are also looking for HVAC designs which will enhance indoor air quality. It has been widely reported that humans are spending 90% of their time indoors. It has been proven that the air we breathe can make us feel unhealthy, deficient and tired. This in fact does affect our health and wellness along with productivity. People expect the air they breathe to be reasonably safe and comfortable. Yet indoor air can be laden with mold, mildew, dander, bacteria, and viruses. As a result of those paradigm shifts, many owners and consulting engineering firms are turning to BPI to meet the new and emerging requirements.

WHAT IS ATMOSAIR BI POLAR IONIZATION?

AtmosAir Bi Polar Ionization (BPI) is a gas phase indoor air purification technology. It works by adding a controlled amount of both positive

and negative air ions to the supply air of air handling system. The negative ions contain an extra electron while the positive ions are missing an electron resulting in an unstable condition (see paragraph opposite).



By understanding the capabilities of Bi Polar Ionization, and properly applying the technology to air handling units, we will be employing a technology to our air handling units which will disinfecting the supply air stream as well disinfect the AHU.

WHERE UTILIZED

AtmosAir has been deployed in healthcare networks, airports, commercial office spaces, schools, sports environments, museums, casinos, and almost all types of indoor environments where the air we breathe is valued.

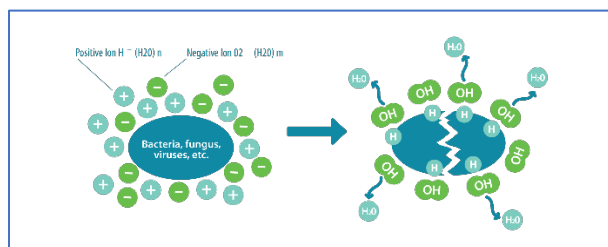


BENEFITS OF ATMOSAIR SYSTEM

Particle Reduction: Up to 95% of Ultrafine Particulate is Reduced

VOC Reduction (Odor Control Solution); Up to 90% of VOCs are oxidized (broken down) to simple, harmless elements.

Mold, Bacteria, Viruses Reduction: Reproductive cycle is interrupted with AtmosAir technology and colony forming units are reduced



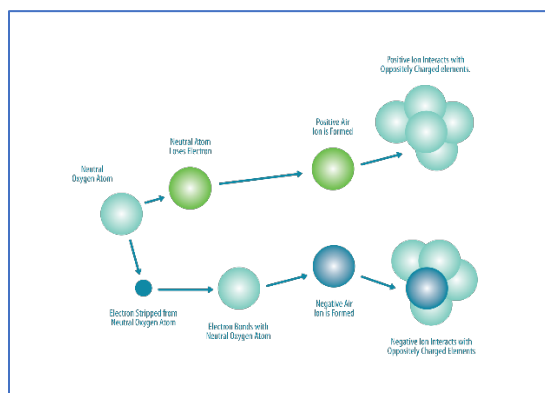
Energy Efficiency Opportunity: 50% Reduction in Outside Air Heating/Cooling Load is Possible with Technology generating 4-8% utility energy savings.

Indoor Air Monitoring: Real-Time Temperature, Relative Humidity, Co2, PM2.5 (particulate), VOCs, Air Quality Index Monitoring

AIR IONS

Very simply an ion is an atom or molecule that has gained or lost an electron. Both positive and negative ions exist in the air. Positive air ions are generally molecules of oxygen that have lost an electron, whereas, a negative air ion is generally a molecule of oxygen that has gained an electron. Negative ions in the air attract particles of pollution and give them a negative charge, making them seek electrical 'ground,' which causes them to fall harmlessly to the floor.

Nature is constantly producing negative ions to combat the pollution in the air.



For example, have you ever noticed how the air is stuffy before a storm and afterwards it is refreshing? This is because lightening produces a high concentration of negative ions, which purifies the air and makes it invigorating. The same is true of waterfalls. At sea level, we typically experience 500 negative and 600 positive ions/cm3. In cities and inside buildings, the ion levels drop by 80% to 95% and are barely detectable in small spaces. In ideal 'fresh

air' environments such as mountain ranges, ion densities range from 500 to 1,500 ions per cubic centimeter (ions/cm³). As the ion density decreases, so does the corresponding air quality. By increasing the quantity of charged oxygen ions, air quality is improved to 'fresh air' levels. The table below shows the small ion count at various locations:

PROACTIVE AIR CLEANING

Not many solutions in the marketplace today are proactively cleaning the air we breathe, 'in the space.' Whereas many systems are located on the return side of the air, AtmosAir is placed on the supply side of the air so that the air ions generated by the systems can safely break down contaminants at their source. AtmosAir will make particulate heavier and therefore more easy to filter. It will also oxidize VOCs and odors leaving the space clean and fresh.

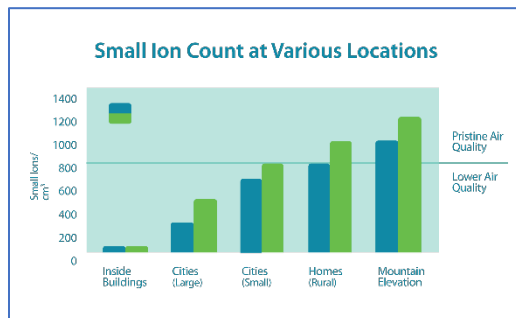


Figure 1 Small Ion Counts at Various Locations

APPLICATION AND PLACEMENT

The AtmosAir ionization system is intended to be mounted in the discharge plenum. The unit is intended to operate only when air flow is present. Thus power to the ionization unit should be interlocked with the fan operation or controlled via an air pressure switch. The size and number of systems is dependent upon the air flow, size of the space, and severity of the pollution and odors. Ionization can be adjusted with the 5-step knob.



AtmosAir in RTU Discharge Plenum

QUANTITY AND SELECTION

Depending on the indoor air quality in the facility, and the supply CFM required, HVAC systems will be equipped with AtmosAir systems in single or multiple quantities.

Indoor Air Quality level is determined by referencing the table below. There is a selection tool the AtmosAir Engineering team has developed that will input your Air Quality selection and CFM that will yield the correct quantity of units, type and model of units for your application. It also generates all other pertinent data necessary for a schedule - Amps, Watts, etc.

Indoor Air Quality Level Selection Table:

Indoor Air Quality Level	Building Description
A	Residences, Airports, Office Spaces, Schools/Classrooms, Day Care Centers
B	Odorous Nursing homes, Locker rooms, Light Manufacturing, Food Processing, Restaurants,
C	Nail/beauty Salons, Smoking Casinos, Waste Water Applications, Industrial Facilities, Garbage rooms, Animal Kennels

CONTINUOUS DISINFECTION

Nature has provided the earth with an abundance of living, breathing and reproducing microbiological agents. These microbiological agents exist all around us, some plainly visible, some too small for the naked eye to see. When not kept in check, these stealth-like unwanted invaders can begin to cultivate, populate and be transmitted through-out a facility leading to odors, illnesses, allergies, and associated allergy symptoms. As long as there is a food source, moisture and acceptable environmental conditions, microbiological growth will flourish and can cause significant problems.

For the purpose of this guide, we will focus on viruses, bacteria and fungi (mold) – these are all challenges within the indoor air and air handling unit.

AtmosAir and Bi Polar Ionization have tested strongly against:

C. difficile

MS2 Bacteriophage (Norovirus Surrogate)

E. Coli

S. saprophyticus (Staph/MRSA)

Cladosporium (Black mold, mildew)

Penicillium/Aspergillus

Coliform Bacteria

Bacillus subtilis

H1N1 influenza virus

Corona Virus

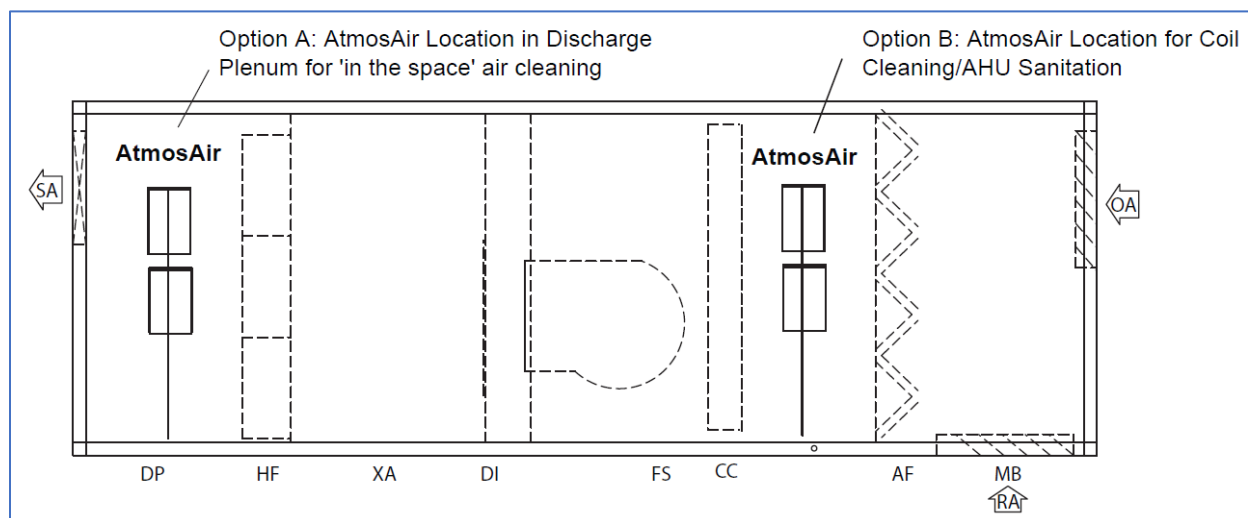
H5N1 avian influenza virus

Airborne Allergens

Ultrafine particles

WHY INDOOR AIR QUALITY IS IMPORTANT

- 90% of our lives are spent indoors. (EPA)
- Indoor air quality is one of the top five most urgent environmental risks to public health. (EPA)
- 72% of toxic chemicals are indoors (UL)
- 125 Million Americans breathe unhealthy levels of air pollution where they live or work. (American Lung Association)
- 50% of all illness is caused by indoor air pollution. (EPA)
- Indoor air can be 2-100x worse than outdoor air. (EPA)



- Pollution readings near highways and urban areas are 3-4x higher than buildings over 1k feet away from these areas. (USC)
- Poor Indoor Air Quality is linked to cognitive function (Harvard)
- Healthy workplaces improve the bottom-line (Harvard, Gensler)
- 213 Million Work Days Lost Per Year due to IAQ (ASHRAE)
- Annual absenteeism rate = 3% per employee or 62.4 hours. 20 Employees Typical Absenteeism = \$41,000 in salary costs (US Dept. of Labor)
- 3.5x Employees who reported the air in their workplace is 'always fresh' were 3.5 more likely to report that their work environment is energizing (Gensler).

SAVING ENERGY

Outside Air (OA) is required by code for ventilation purposes in all occupied spaces. The International Mechanical Code (IMC) allows for two approaches to calculate OA rates for various indoor spaces:

1. *Ventilation Rate Procedure IMC 403.3:* This uses a prescriptive method for calculating outside air rates based against values set out in the code for various spaces.
2. *An engineered solution* that 'demonstrates that the ventilation system design will prevent the maximum concentration of contaminants from exceeding that obtainable by the rate of outdoor air ventilation determined in accordance with section 403.3'

The second approach would be proposed to allow for the inclusion of AtmosAir BPI in a project to save on first costs and future energy costs.

Using an engineered solution, the amount of OA required for indoor spaces can be reduced provided the language of the code is met i.e. the concentration of contaminants in the space is less than or equal to that obtainable by the Ventilation Rate Procedure.

ASHRAE Standard 62.1 2007 outlines an approach that is an alternate to the Ventilation Rate Procedure (VRP) called the Indoor Air Quality Procedure (IAQP) which has been accepted by the IMC as an alternate method.

Applying these procedures have yielded a 20-40% on HVAC power demand and up to an 8% savings on utility bills.



ENERGY SAVINGS BENEFITS

In addition to IAQ the inclusion of BPI has the potential to reduce OA rates by more than 50% of those required under the Ventilation Rate Procedure (VRP). This has the following benefits:

Cooling load reduction: Reducing the OA intake will require less cooling of the OA for supply to the building.

Potential HVAC equipment reduction: With the reduction of OA the size of HVAC equipment treating the OA reduces in size also. This saves space in the plantroom and reduces the size of enthalpy wheels, and intake and exhaust louver requirements. Additionally, OA ductwork and associated duct accessories are all reduced. It also may avoid having to add chiller tonnage.

Running cost reduction: With the reduction in amount of OA, the fan size is decreased and hence the electrical draw is decreased further reducing running costs.

Code Compliance: AtmosAir has the ability to prepare and meet the requirements of IECC and IMC 2012, ASHRAE 90.1 and ASHRAE 62.1-2016. ASHRAE requires specific information be included in the design documentation when the indoor air quality procedure is used. The following documentation is included within AtmosAir's IAQp tool in accordance with ASHRAE 62.1-2013 section 6.3.6:

1. Identification of contaminants of concern
2. Determination of maximum contaminant levels, exposure periods and reference to cognizant authority.
3. Use of steady-state dynamic mass balance equations to establish outdoor air ventilation rates.
4. Schedule for inclusion in the design documents

MAINTENANCE, POWER, and CONTROL

AtmosAir systems come with composite BPI tubes. Tubes need to be changed every two years.

AtmosAir is installed in the AHU and can be connected to a BMS for monitoring.

Power used by the product is minimal.

REAL TIME MEASUREMENT AND VERIFICATION

AtmosAir has many ancillary options including AtmosAware sensors which monitor, track, and report to customer six parameters of Indoor Air Quality including: Temperature, Relative Humidity, Co2, PM2.5 (particulate), VOCs, Air Quality Index Monitoring.

AtmosAir Bi Polar Ionization Technology - Frequently Asked Questions

1. What is AtmosAir Bi-Polar Ionization?

AtmosAir Bi-Polar ionization (BPI) is an indoor air purification technology. It works by adding a controllable amount of both positive and negative oxygen ions to the supply air of an air handling system. Very simply an ion is an atom or molecule that has gained or lost an electron. Both positive and negative ions exist in the air. By increasing the quantity of charged oxygen ions, air quality is improved to 'fresh air' levels.

2. How does AtmosAir reduce particulate matter (PM)?

Oppositely charged AtmosAir bi polar air ions cause particles to attract to other particles and become bigger and heavier, by a process called "agglomeration". These bigger heavier particles can now be better trapped by HVAC system filters so the filters operate more efficiently. Many small particles that are generated within a space by people and their activities may never get to system filters and ordinarily stay suspended in air for long periods and can be breathed in, increasing the chance of illness and respiratory distress. The AtmosAir bipolar ion process will drop these to the floor quickly taking them away from where we breathe.

3. How does AtmosAir reduce Volatile Organic Compounds (VOCs)?

AtmosAir Bi-Polar ions surround the VOC and break down hydrocarbon chains that ultimately make these complex compounds into immeasurable levels of carbon dioxide and water vapor

4. How does AtmosAir work against various bacteria, viruses, and germs.

AtmosAir positive and negative ions surround the hemagglutinin (surface proteins that form on organisms and trigger infections) and change into highly reactive OH groups called hydroxyl radicals. These take a hydrogen molecule from the hemagglutinin and change into water (H₂O). The 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.

5. Does AtmosAir really work?

Yes, hundreds of references to BPI effectiveness can be found in published literature. AtmosAir has been third party tested by the likes of UL, ETL, ATL Laboratories, Microchem Laboratories, and various respected laboratories. AtmosAir Bi Polar Ionization has been used worldwide.

6. Does AtmosAir have a device that measures ion levels?

Yes, we have a specially designed ion meter that will read ion levels.

7. Does the ionization system increase the oxygen content in air?

No. The technology increases the number of oxygen ions, not the number of oxygen molecules. It revitalizes stable oxygen molecules into unstable oxygen ions – these ions want to react with pollutants by trading electrons to become stable again.

8. Does AtmosAir produce ozone?

No, AtmosAir has been tested to UL-867 standards and will not produce measurable amount of ozone in occupied spaces.

9. Are AtmosAir systems UL listed.

Yes. For complete safety, our systems have been tested and Listed as UL under Category Code ABQK (Accessories, Air Duct Mounted), UL Standards: 1995 and 867 respectively, no exceptions. AtmosAir is also Energy Star Certified, EU Standard certified, and ANSI/AHAM 3rd party tested.

10. How do I know that my AtmosAir system is working properly?

First, perform a local check and ensure that the green light on the front of your ionization unit is illuminated. If the green light is not on, call the contractor that installed your unit and have them service it. If the green light is on but you do not feel that the air is being cleaned sufficiently, you can turn the ionization control knob up until you are satisfied with the air quality. If your ionization tube has not been replaced within the last 24 months, you should contact your distributor or contractor and have them replace the tube.

11. How often should the AtmosAir ionization tubes be changed?

AtmosAir Composite tubes will degrade and become ineffective after approximately 2 years. In this case the tubes should be changed once every two years.

12. Is it dangerous to look at the ionization tube while it is operating?

No. Unlike UV lamps, which can harm your eyes, there is no danger in looking at a powered ionization tube.

13. Is touching the ionization tubes dangerous?

Yes, if the ionization unit is powered and you touch the tube, you could be injured. Therefore, before touching the tube or removing it for annual replacement, make sure the power to the unit is off by unplugging it from the power source.

14. What is the maximum temperature that the ionization tube can be subjected to?

The tubes should not be subjected to temperatures exceeding 150 Degrees Fahrenheit.

15. What is the warranty of my system?

AtmosAir warrants the life of the system for two calendar years. Many commercial projects are warrantied for the life of however long a client changes his tubes and maintains his system in a timely efficient manner.

16. What is sick building syndrome?

Sick building syndrome (SBS) occurs when occupants of a building experience acute health effects that seem to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone, or may be widespread throughout the building. Frequently, problems result when a building is operated or maintained in a manner that is

inconsistent with its original design or prescribed operating procedures. Sometimes indoor air problems are a result of poor building design or occupant activities

17. Is AtmosAir effective in 100% outside air units?

AtmosAir systems are equally effective whether the air system is 100% outside air and exhaust air, or 100% re-circulated air, or something in between. AtmosAir systems generate bi-polar ions which are then carried by the supply air and distributed through the supply diffusers into the indoor space. The engineering of our systems is to saturate the space with ions and the ions to react with contaminants within the space. Most ions are spent up in the space by these continual reactions, some may exit through the return air but are spent up by media filters, so even in a re-circulation air system, ions do survive the trip back. If the AtmosAir system is designed and engineered correctly, the indoor space will be enriched with bi-polar ions, resulting in cleaner air.

18. My room smells of smoke, will AtmosAir help?

Yes, AtmosAir is installed in various cigar bars as well as casinos which have lots of smokers. Smoke mitigation is a strength of the AtmosAir system and will help a facility reduce the complex contaminants that make up smoke.

Filter Questions and Other Air Purification Technologies

1. How is AtmosAir technology different than other air purifiers on the market?

Most technologies you see on the market today are “passive” technologies. Media filters that catch particles in the return air stream are the most common. UV or PCO filtration systems that purify air on the return side of the air system. AtmosAir is a “proactive” air cleaning system. AtmosAir will work to clean the air people are breathing in their occupied space.

2. Will I still need to change the filters in my heating and air conditioning system?

Yes, the AtmosAir equipment is not a catch and grab filter. It does not trap particles but rather reduces airborne pollutants and particles in the occupied space – where you live, eat, sleep, etc. In fact, because your AtmosAir system causes airborne particles to stick together, your filters will become more efficient by trapping these larger particles.

3. Don't filters remove microorganisms, VOCs, and particles?

Typical media filters do not do a great job against microorganisms, VOCs, and particles. High efficiency media filters are best against particles, but do not see up to 70% of the air that finds it's way into 'the space.' Some filters are capable of “catching” or eliminating particles and VOCs from the air stream but they do not effectively break down microorganisms, VOCs, and particles at their source so that they do not reproduce.

4. Does AtmosAir Bi Polar Ionization replace media filters?

No, AtmosAir Bi Polar Ionization is an air conditioning component that works in conjunction with mechanical filtration and is not intended to replace components such as filters, etc.

5. How is AtmosAir different than UV lights?

UV lights are only effective on a handful of contaminants of concern (COC) and these COCs would have to pass through the UV light rays for a period of time long enough to be effective. UV lights *do not* treat any of the air in the occupied space, nor are they effective on VOCs and odors. UV lights require that the air be returned to the air handling system – we label this a “reactive” system. However, UV lights can only help the performance of your AtmosAir systems and overall indoor air quality. Many hospitals have both AtmosAir BPI and UV lights in order to be proactive against bacteria and COCs. UV lights have also traditionally been used to keep cooling coils clean.

Sizing Questions

1. How do I size my AtmosAir Bi Polar Ionization System?

AtmosAir has developed a sizing spreadsheet which will quickly help generate an AtmosAir selection schedule. Consult AtmosAir application engineers for custom solutions and guidance.

2. How is the Indoor Air Quality Level Selection Table used in sizing?

Based on experience, different environments call for a different amount of systems. As an example, in a gaming environment there is many more contaminants to deal with so AtmosAir has designed a product selection tool around providing the right equipment for the right building.