

WHITE PAPER:

Cost Effective Solutions to Improving Indoor Air Quality



The air around us is filled with particles of dust, dander, pollen, and smoke, as well as gases and vapors that emit from building materials and mold. Indoor air could be much more harmful than the worst outdoor air, according to the Environmental Protection Agency.

This is significant in that most of us spend more time indoors than out. In fact, 96% of buildings surveyed recently by the EPA had indoor air quality issues. Of these, 86% had high levels of dust, pollen, viruses, and other pollutants. The air in 71% had potentially harmful chemicals and gases.²



What is in Your Indoor Air?

Air is made up of particulates, gases, and vapors, and can become polluted by a number of factors, leading to poor air quality.

Indoor air quality (IAQ) is actually measured by the concentrations of various pollutants including:

- Dust and dust mites
- Carbon dioxide (CO₂)
- Mold and mildew
- Airborne fungi
- Volatile Organic Compounds (VOC's)
- Bacteria and viruses
- Pathogens that cause disease

A high concentration of these pollutants can pose health threats of varying levels of severity – from lethargy, lack of attention, drowsiness, headaches, sore throat, dry and itchy skin, eye dryness, and sinus infections, to respiratory distress and other more severe health conditions. Severe concentrations in a building are defined as “Sick Building Syndrome” (SBS).

The presence of these kinds of pollutants is attributed to a number of sources and causes, including:

- Low ventilation rates.²
- Moisture or dirt in an HVAC system, filters, and humidification devices.⁷
- Outdoor pollutants or vehicle exhaust.³
- Presence of water damage or microbiological pollutants (such as mold and bacteria).⁴
- Animal and other biological allergens.⁵
- Combustible byproducts like nitrogen or carbon monoxide from heat sources using fossil fuels.⁶
- Formaldehyde.⁸
- Chemicals in cleaning products.⁹
- VOCs (volatile organic compounds) used in paints and lacquers or glues and adhesives.
- Asbestos found in buildings built before 2000.
- Ozone and fugitive chemical emissions from electronic equipment.

Barriers to an Effective Solution

Most air quality problems are blamed on antiquated ventilation that calls for replacement or upgrades to the current HVAC system. These are costly capital expenses that are delayed or deferred because they are unaffordable. The truth is that drastic improvements can be made to air quality without even touching the current HVAC system. Features from Air-Row Fans can bring about pure air quality with a small investment that can have a short-term return.

The Solution to Your Indoor Air Quality

The solution from Air-Row Fans is a 3-Step Approach – Ventilation, Purification, and Filtration.

- 1. Ventilation.** The installation of Air-Row fans provide an immediate change to air quality. Air-Row fans for Open or Grid ceilings capture the air that is already there – including stale air trapped at the ceiling – and treat it and circulate it for a change at least once every hour.
- 2. Purification.** Air-Row fans can now be equipped with a Bi-Polar Ionization Cartridge that improves air quality even further and targets impurities in the air and sends them to the floor. Nearly all particulates, gases and vapors are captured and neutralized, sending dust, mold spores, bacteria, viruses, and other pathogens to the floor.
- 3. Filtration (and added purification).** Air-Row recommends two effective tools at the air exchanger –
 - A filter with at least a MERV-13 rating, as MERV 13 filters are 99% effective in trapping particles as low as 0.3 microns in size; and
 - A UV-PCO (ultra-violet photocatalytic) bulb. Bulbs should only be used within the air exchanger where they can be shielded from sight. As rays are dangerous to human view, bulbs used in fans are discouraged.

Commercial Applications

- Hospitals and Health Care Facilities
- Veterinary Offices
- Schools and Colleges
- Restaurants and Food Prep Facilities
- Retail Stores and Shopping Malls
- Fitness Centers and Gyms

Buildings can also benefit with the installation of CO2 and VOC sensors.

- CO2 sensors continually monitor the space for adequate ventilation, and
- VOC monitor the level of potential pollutants in the indoor air of school buildings.

Solutions from Air-Row Fans

Air-Row Fans sells its high-performance destratification fans with Bi-Polar Ionization technology neutralizes the air to be free of ozone and other harmful byproducts.

Our fans use Bi-Polar Ionization to neutralize airborne particulates, gases and vapors that spread disease. In the process, we save up to 30% on HVAC-related energy consumption and lower your carbon footprint.



What is Air Ionization?

Clean air is achieved with an electrical balance of positive and negative ions. An ion is a molecule or atom that is positively or negatively charged, meaning it must either gain or relinquish electrons to become neutral. Since air quality contaminants are positively charged particles, when these contaminants are exposed to negative ions, they are neutralized electrically.

Bi-Polar Ionization is the process that happens when an air ionizer or ion generator releases negative ions into the air to attach to these positive ion contaminants. These bonded molecules then have an increased weight that forces them to fall to the ground. Air is purified as a result, sending all the unwanted particles to the surface to be cleaned, disinfected and eliminated.

Air ionization is a safe process, producing no ozone. The cartridges are low maintenance, easy-to-install, and energy efficient, as they consume very little power. They are highly effective on pollutants such as particulate matter, bacteria, viruses, mold spores, odors, and VOCs found in carpet, upholstery, and building products. According to numerous scientific studies, ionization is the best method to ensure a healthy indoor air quality for human occupancy.

Benefits of Negative Ion Generation

- Elimination of microbes such as Virus or Bacteria
- Reduction of pollen levels
- Elimination of mold spores
- Reduction of dust and dust mite levels
- Elimination of smoke
- Reduction of hay fever and asthma symptoms
- Mood improvement
- Improvement in depression and seasonal affective disorder symptoms
- Improvement in chronic fatigue symptoms
- Reduction in odors

Independent Laboratory Testing

BPI cartridges from Air-Row Fans use an advanced Needlepoint Bipolar Ionization process. The cartridges feature two precise brush emitters made from carbon fiber that supply an ion count of 49.8 million ions/cm³ @ 115V. With the help of our 630+ CFM producing axial destratification fans, our BPI units can help clean and neutralize areas up to 1,200 square feet per application.

Negative ionization has been tested by independent, accredited laboratories to determine its effectiveness. Below are the results, listing the incubation period and the rate of reduction of specific pathogens tested. Tests were conducted by EMSL Analytical, a platinum-rated lab used by The Center for Disease Control.



Norovirus -- **93.5%** after 30 minutes of activation



Human Coronavirus 229E -- **90%** after 60 minutes of activation



Legionella -- **99.7%** after 30 minutes of activation



Clostridium Difficile -- **86.8%** after 30 minutes of activation



Tuberculosis -- **69%** after 60 minutes of activation



MRSA -- **96.2%** after 30 minutes if activation



Staph -- **96%** after 15 minutes activation



E. coli -- **96.2%** after 30 minutes of activation



Airborne Mold -- **99.5%**, per tests by the Indoor Environment Tests Organization

The Fight Against COVID-19?

Bi-Polar Ionization has been tested on Sars-CoV-2 (COVID-19) and test results showed a 99.4% inactivation of viral particles at 30 minutes under conditions replicating an occupied building. Research shows that bipolar ionization, specifically NPBI (Needlepoint Bipolar Ionization) provides fast and continuous microbe inactivation in climate-controlled spaces. Studies have shown that ten minutes of exposure to needlepoint bipolar ionization dropped virus levels by 84 percent.

Conclusions and Recommendations

Air-Row Fan products are created and designed to change and improve air distribution and ventilation, and have a successful track record in capturing and mixing trapped air, targeting air strategically, making regular air changes, and reimagining the thermal balance of air in buildings.

Air-Row recommends a 3-Fold Approach to improving air quality:

- 1) Ventilate -- Our F-18 and LA-248 destratification fans to provide regular air rotations;
- 2) Purify – Add our BPI Bi-Polar Ionization Cartridge to neutralize particulates, gases, and vapors, and throw pollutants to the floor where they may be disinfected and eliminated; and
- 3) Filtrate -- At the front end of the air handling system, Air-Row Fans recommends our UV-PCO (Ultra-Violet Photocatalytic Oxidation) Bulbs and HEPA filters with at least a MERV-13 rating.

Sources:

1. “Facts About Indoor Air Quality,” Environmental Protection Agency.
2. Menzies, R., R. Tamblin, et al. 1993. “The effect of varying levels of outdoor-air supply on the symptoms of sick building syndrome.” *New England Journal of Medicine* 328(12):821-827. and Milton, D.K., P.M. Glencross, et al. 2000. “Risk of sick leave associated with outdoor air supply rate, humidification, and occupant complaints.” *Indoor Air* 10(4):212-221.
3. Guo, Y.L., Y.C. Lin, et al. 1999. “Climate, traffic-related air pollutants, and asthma prevalence in middle-school children in Taiwan.” *Environmental Health Perspectives* 107(12):1001-1006. and Steerenberg, P.A., S. Nierkens, et al. 2001. “Traffic-related air pollution affects peak expiratory flow, exhaled nitric oxide, and inflammatory nasal markers.” *Archives of Environmental Health* 56(2):167-174. and Wyler, C., C. Braun-Fahrlander, et al. 2000. and “Exposure to motor vehicle traffic and allergic sensitization. The Swiss Study on Air Pollution and Lung Diseases in Adults (SAPALDIA) Team.” *Epidemiology* 11(4):450-456.
4. Bornehag, C.G., G. Blomquist, et al. 2001. “Dampness in buildings and health: Nordic interdisciplinary review of the scientific evidence on associations between exposure to ‘dampness’ in buildings and health effects (NORDDAMP).” *Indoor Air* 11(2):72-86. and Institute of Medicine. Committee on the Assessment of Asthma and Indoor Air. 2000. *Clearing the Air: Asthma and Indoor Exposures*. Washington, D.C., National Academy Press.
5. Platts-Mills, T.A.E. 2000. “Allergens derived from arthropods and domestic animals.” *Indoor Air Quality Handbook*. Eds., J. Spengler, J. M. Samet, and J. F. McCarthy. New York, McGraw-Hill:43.1-43.15.
6. Pilotto, L.S., R.M. Douglas, et al. 1997. “Respiratory effects associated with indoor nitrogen dioxide exposure in children.” *International Journal of Epidemiology* 26(4):788-796.
7. Milton, D.K., P.M. Glencross, et al. 2000. “Risk of sick leave associated with outdoor air supply rate, humidification, and occupant complaints.” *Indoor Air* 10(4):212-221. and Sieber, W.K., L.T. Stayner, et al. 1996. “The National Institute for Occupational Safety and Health indoor environmental evaluation experience. Part Three: Associations between environmental factors and self-reported health conditions.” *Journal of Occupational and Environmental Hygiene* 11(12):1387-1392
8. Norbäck, D., R. Walinder, et al. 2000. “Indoor air pollutants in schools: Nasal patency and biomarkers in nasal lavage.” *Allergy* 55(2):163- 170. and Franklin, P.J., P.W. Dingle, et al. 2000. “Formaldehyde exposure in homes is associated with increased levels of exhaled nitric oxide in healthy children.” *Proceedings, Healthy Buildings 2000*. Espoo, Finland.1:65-70. and Garrett, M.H., M.A. Hooper, et al. 1999. “Increased risk of allergy in children due to formaldehyde exposure in homes.” *Allergy* 54(4):330-337.
9. McCoach, J.S., A.S. Robertson, et al. 1999. “Floor cleaning materials as a cause of occupational asthma.” *Proceedings, Indoor Air '99: The 8th International Conference on Indoor Air Quality and Climate*. Edinburgh, Scotland. 5:459-467. and Zock, J., M. Kogevinas, et al. 2001. “Asthma risk, cleaning activities and use of specific cleaning products among Spanish indoor cleaners.” *Scandinavian Journal of Work, Environment, and Health* 27:76-81.