



IONIZATION WHITE PAPER

NEGATIVE ION GENERATION:

What is it? What are its benefits? What are its applications?

The Need for Clean Air – Indoor air pollution is among the top five environmental health risks. The sources of airborne gaseous organic compounds include tobacco smoke, building materials and furnishings, as well as products including paints, dyes, deodorizers, cleaning chemicals, adhesives and pesticides. The indoor air quality of most homes and commercial buildings lack the proper “electrical” balance needed to provide a healthy and clean environment. The desire to build “air tight” homes and buildings in an effort to reduce energy consumption has also drastically reduced the quality of the air inside these facilities. In addition, most homes and buildings are located in urban environments consisting of asphalt and concrete streets and parking areas, combined with densely packed buildings. As a result of this and other factors, the air in urban areas is not “electrically” balanced enough to provide good outside air quality.

Most particles including dust, pollen, smoke, animal dander, odors, and chemical fumes, have a positive charge. Current homes and buildings are built with energy loss reduction in mind. This means buildings generally have an inadequate amount of negative ions in the air. In addition fluorescent lights, computer screens, plasma and LCD TVs, ventilation systems and newer building materials and fabrics contain a high concentration of positive ions.

Scientific studies have shown that positive ions can lead to tiredness, fatigue and irritability and that an increase in negative ions, in an indoor environment, can produce reductions in seasonal depression, asthma, allergic reactions, fatigue, moodiness and headaches. Thus, the ability to generate a negatively charged environment, in an indoor space, can lead to many health benefits.

Types of Air Cleaners – There are multiple types of air cleaning devices available for home and commercial use. The following is a list of the more common air cleaning devices along with some advantages and disadvantages of each.

- 1. Electrostatic Air Cleaners** – These devices use charged plates to attract positively charged particles as they move through the air. These are generally designed for small areas and can clean only a small volume of air. These devices do not have filters but they do have plates that need to be cleaned periodically.
- 2. Ultraviolet (UV) Air Cleaners** - UV light is an effective way to kill bacteria, viruses and mold in the air; however, typical UV filters used in a home have a very limited effectiveness in killing them. Killing these pathogens in a home requires a much higher UV exposure than a typical home unit is capable of generating. In addition, these devices do not remove gases, odors or particles from the air. A filter is required in conjunction with the UV lamp to provide additional air cleaning. UV tubes are expensive and need to be replaced periodically. Environmentally speaking, UV tubes are made of glass and can be hazardous to handle.
- 3. Ozone Air Cleaners** - Ozone is an unstable molecule of three Oxygen atoms (O₃). It can be generated by an electrical process. Ozone can be an effective way of eliminating odors, chemicals and mold, although too much ozone can be a health hazard.
- 4. HEPA Air Filters** – High Efficiency Particle Arresting (HEPA) filters are made of paper or polymer which are densely packed to reduce the air flow and stop particles from entering the air stream. HEPA filters are often used in hospital or clean room environments. They are not well suited for homes or commercial spaces due to the limitation of air flow that results from these filters. HEPA filters need to be changed quite often due to their construction and restrictive air flow properties.
- 5. Negative Ion Generators** – This type of air cleaner generates negative ions which attract positively charged particles, causing them to fall to the floor and become inert. Negative ion generators use high voltage to create negative ions (particles with one or more extra electrons). These devices do not have tubes or filters so they are much easier to maintain.

What are Negative Ions? – As noted above, negative ions are electrically charged particles that have extra electrons. Air quality contaminants are positively charged particles. When these contaminants are in the presence of negative ions, the contaminants are neutralized electrically causing the particles to fall to the floor or other surfaces, cleansing the air where humans breathe. In order to keep the indoor air negatively charged, negative ions need to be constantly generated in the normal air flow path.

Ever wonder why the air smells so fresh during electrical storms, near waterfalls or by the sea shore? This is because negative ions are created by nature. Negative ions have been shown to be an effective means of cleaning the air of odors, pollen, dust and other contaminants. There are also many studies that show the rejuvenating effect on a person's mood through the implementation of negative ionization.

While negative ion generators and ozone generators operate in a similar fashion, they are not the same device. Ozone generators are designed to attract an extra oxygen atom that attaches to an O₂ molecule, creating an O₃ molecule. This process is accomplished using a UV light or a corona discharge tube. A Negative Ion Generator creates negatively charged ions using voltage to electrically charge the passing air flow. As a result, small amounts of Ozone are produced.

Negative ions and Ozone perform different functions in cleaning the air. Ozone can eliminate odors and some pollutants, but also creates a distinct odor in high concentrations. Negative ions can remove pollen, dust and mold; as well as improve a person's attitude and is completely odorless.

Excessive Ozone levels can be harmful to your health, however excessive Negative Ionization is not at all dangerous and is actually beneficial to a person's well-being.

Benefits of Negative Ion Generators –The following are some of the many benefits that are associated with the introduction of negative ions to an indoor environment:

- Reduction of pollen levels
- Reduction of animal dander
- 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 household odors
- Reduction in chemical odors from materials or fabrics

Negative Ion Generators can purify indoor air by causing contaminants such as dust, pollen, animal dander, mold spores and bacteria to be neutralized electrically. Negative ionization causes these particles to be attracted to each other and ball up; falling to the floor or other surfaces to be cleaned up by the normal cleaning process. Ionized air does not have to pass through a filter to perform this action.

The Negative Ion Generator only needs to be installed in normal ductwork in a home or building to continually treat the inside air. The introduction of negative ions in this fashion will eliminate a lot of the floating contaminants in the air like the dust you see in a ray of sunshine. The ability to improve a person's mood or reduce seasonal disorders by the introduction of negative ions in the air is certainly a positive side benefit.

Commercial Applications – The following are some of the better applications for negative ion generators in commercial environments due to the nature of the problems associated with these environments:

- Hospitals
- Convention centers and arenas
- Schools
- Animal feeding and processing plants
- Shopping malls
- Laboratories
- Restaurants and food preparation areas
- Veterinary offices
- Nursing Homes
- Churches and synagogues
- Doctor's offices
- Jails
- Casinos
- Museums

Clinical Studies – The following are a few brief examples of the various clinical studies that have been done on the effects of negative ions in an indoor environment.

1. **SAD** – A study was conducted on the reaction of participants suffering from Seasonal Affective Disorder to high levels of negative ions. The results showed that the treatment was effective in reducing the symptoms of the disease. Click hyperlink below to see the study.

<http://www.chronotherapeutics.org/docs/term/Terman%202006%20AJP.pdf>

2. **Newcastle Disease Virus** - In many cases, dust will carry microorganisms that cause infections. In a 1994 study, it was determined that negative ionization can reduce the incidence of infections in poultry houses. (Mitchell, B.W. a. D. J. K. (1994). "Effect of negative air ionization on air borne transmission of Newcastle disease virus." Avian Diseases 38: 725- 732.)

3. **Dental Clinics** – A study of dental clinics in 1990 found that Colony Forming Units in the air were reduced by over 30% when subjected to continuous negative ions. (Gabbay, J. (1990). "Effect of ionization on microbial air pollution in the dental clinic." Environ. Res. 52(1): 99)

4. **Bacterial Aerosols** – A burns and plastic surgery unit was able to significantly reduce the amount of airborne bacterial aerosols using negative ion generation. (Makela, P., J. Ojajarvi, et al. (1979). “Studies on the effects of ionization on bacterial aerosols in a burns and plastic surgery unit.” J. Hyg. 83: 199-206.)

5. **Mood** - “Negative ions increase the flow of oxygen to the brain; resulting in higher alertness, decreased drowsiness, and more mental energy,” says Pierce J. Howard, PhD, author of *The Owners Manual for the Brain: Everyday Applications from Mind Brain Research* and director of research at the Center for Applied Cognitive Sciences in Charlotte, N.C. “They also may protect against germs in the air, resulting in decreased irritation due to inhaling various particles that make you sneeze, cough, or have a throat irritation.

6. **Human Body** – An article in *Economy Daily News*” - January 30, 2002 indicated that negative ions 1: Strengthen the functions of autonomic nerves, 2: Reinforces collagen (tissues that are resilient and tension related), 3: Improves the permeability of the cell’s prototype plasma membranes (improves metabolism) 4: Strengthens the body’s immune system.

7. **Longevity** – An article by John Heinerman, Ph.D on **Negative ion regeneration for youthfulness and longevity** suggests that negative ions neutralize pollutants and provide positive effects on health to:

- Stimulate the reticulo-endothelial system, a group of defense cells in our bodies that marshal our resistance to disease.
- Act on our capacity to absorb and utilize oxygen. Negative ions in the bloodstream accelerate the delivery of oxygen to our cells and tissues.
- Speed up oxidation of serotonin (5-hydroxytryptamine) in the blood. This is well known to have far reaching effects on mood, pain relief and sexual drive.

8. **Asthma** - At the University of Pennsylvania's Graduate Hospital and at Northeastern and Frankford hospitals in Philadelphia, Dr. Kornblueh administered negative-ion treatments to patients suffering from hay fever or bronchial asthma. Over 60 percent have experienced partial to total relief.

9. **Burn Pain** - Dr. Kornblueh also studied brain-wave patterns and found evidence that negative ions tranquilized people in severe pain. Now, burn cases at Northeastern are immediately put in a windowless, ion conditioned room. Patients are left in the room for 30 minutes. The treatment is repeated three times for a full day. In 85 percent of the cases, no pain deadening narcotics are needed. Burns dry out faster; heal faster and with less scarring. They also reduce the need for skin-grafting.

10. **Airborne Allergens** - Experiments by Dr. Albert P. Krueger and Dr. Richard F. Smith at the University of California have shown how ionization affects those sensitive to airborne allergens. Bronchial tubes and trachea, or windpipe, are lined with tiny filaments called cilia. The cilia normally maintain a whip like motion of about 900 beats a minute. Together with mucus, they keep our air passages free of dust and pollen. Krueger and Smith exposed tracheal tissue to negative ions, found that the ciliary beat was speeded up 1200 a minute and that mucus flow was increased. Doses of positive ions produced the opposite effect: ciliary beats slowed to 600 a minute or less; the flow of mucus dropped.

11. **Cigarette Smoke** - In experiments involving cigarette smoke, Drs. Krueger and Smith also discovered that cigarette smoke slows down the cilia and impairs their ability to clear foreign and possibly carcinogenic (cancer-inducing), substances from the lungs. Positive ions, administered along with cigarette smoke, lowered the ciliary beat as before, but from three to ten times faster than in normal air. Negative ions however, counteracted the effects of the smoke.