



Building Air Quality

P.O. Box 9326 The Woodlands, Texas 77387-9326
tel: 281-448-1100 fx: 281-296-2889
iaqsolutions@baq1.com
www.baq1.com

Ozone Generators in Indoor Air Quality

Ozone generators that are sold as air cleaners intentionally produce the gas ozone. Often the vendors of ozone generators make statements and distribute material that lead the public to believe that these devices are always safe and effective in controlling indoor air pollution. Some vendors suggest that these devices have been approved by the federal government for use in occupied spaces. To the contrary, NO agency of the federal government has approved these devices for use in occupied spaces.

What is Ozone?

Ozone is a molecule composed of three atoms of oxygen. Two atoms of oxygen form the basic oxygen molecule. This is the oxygen we breathe that is essential to life. The third oxygen atom can detach from the ozone molecule, and re-attach to molecules of other substances, thereby altering their chemical composition. It is this ability to react with other substances that forms the basis of manufacturers' claims.

How is Ozone Harmful?

When inhaled, ozone can damage the lungs. Relatively low amounts can cause chest pain, coughing, shortness of breath, and, throat irritation. Ozone may also worsen chronic respiratory diseases such as asthma and compromise the ability of the body to fight respiratory infections.

Manufacturers and vendors of ozone devices often use misleading terms to describe ozone. Terms such as "energized oxygen" or "pure air" suggest that ozone is a healthy kind of oxygen. Ozone is a toxic gas with vastly different chemical and toxicological properties from oxygen.

Can Ozone Generators Control Indoor Air Pollution?

Available scientific evidence shows that at concentrations that do not exceed public health standards, ozone has little potential to remove indoor air contaminants. Some manufacturers or vendors suggest that ozone will render almost every chemical contaminant harmless by producing a chemical reaction whose only by-products are carbon dioxide, oxygen and water. This is misleading.

For many of the chemicals with which ozone does readily react, the reaction can form a variety of harmful or irritating by-products. For example, in a laboratory experiment that mixed ozone with chemicals from new carpet, ozone reduced many of these chemicals, including those that can produce new carpet odor. However, in the process, the reaction produced a variety of aldehydes, and the total concentration of organic chemicals in the air increased rather than decreased after the introduction of ozone. In addition to aldehydes, ozone may also increase indoor concentrations of formic acid, both of which can irritate the lungs if produced in sufficient amounts.

Ozone does not remove particles (e.g., dust and pollen) from the air, including the particles that cause most allergies. However, some ozone generators are manufactured with an "ion generator" or "ionizer" in the same unit. An ionizer is a device that disperses negatively (and/or positively) charged ions into the air. These ions attach to particles in the air giving them a negative (or positive) charge so that the particles may attach to nearby surfaces such as walls or furniture, or attach to one another and settle out of the air. In recent experiments, ionizers were found to be less effective in removing particles of dust, tobacco smoke, pollen or fungal spores than either high efficiency particle filters or electrostatic precipitators.

Some data suggest that low levels of ozone may reduce airborne concentrations and inhibit the growth of some biological organisms while ozone is present, but ozone concentrations would have to be 5 - 10 times higher than public health standards allow before the ozone could decontaminate the air sufficiently to prevent survival and regeneration of the organisms once the ozone is removed.

If used at concentrations that do not exceed public health standards, ozone applied to indoor air does not effectively remove viruses, bacteria, mold, or other biological pollutants.

Is Ozone Equipment Harmful?

There are many brands and models of ozone generators on the market. They vary in the amount of ozone they can produce. In many circumstances, the use of an ozone generator may not result in ozone concentrations that exceed public health standards. But many factors affect the indoor concentration of ozone so that under some conditions ozone concentrations may exceed public health standards.

In one study, a large ozone generator recommended by the manufacturer for spaces "up to 3,000 square feet," was placed in a 350 square foot room and run at a high setting. The ozone in the room quickly reached concentrations that were exceptionally high--0.50 to 0.80 parts per million which is 5-10 times higher than public health limits. [The concentrations reported were adjusted to exclude that portion of the ozone concentration brought in from the outdoors. If the outdoor portion of ozone were included in the indoor concentrations reported, the concentrations inside would have been correspondingly higher, increasing the risk of excessive ozone exposure.]

Can Ozone Be Used in Occupied Spaces

High concentrations of ozone in air are sometimes used to help decontaminate an unoccupied space from certain chemical or biological contaminants or odors (e.g., fire restoration). However, little is known about the chemical by-products left behind by these processes. While high concentrations of ozone in air may sometimes be appropriate in these circumstances, conditions should be controlled to insure that no person or pet becomes exposed.

Conclusions

Whether in its pure form or mixed with other chemicals, ozone can be harmful to health. When inhaled, ozone can damage the lungs. Relatively low amounts of ozone can cause chest pain, coughing, shortness of breath and, throat irritation. It may also worsen chronic respiratory diseases such as asthma as well as compromise the ability of the body to fight respiratory infections.

Some studies show that ozone concentrations produced by ozone generators can exceed health standards even when one follows manufacturer's instructions. Many factors affect ozone concentrations including the amount of ozone produced by the machine(s), the size of the indoor space, the amount of material in the room with which ozone reacts, the outdoor ozone concentration, and the amount of ventilation. These factors make it difficult to control the ozone concentration in all circumstances.

Available scientific evidence shows that, at concentrations that do not exceed public health standards, ozone is generally ineffective in controlling indoor air pollution. The concentration of ozone would have to greatly exceed health standards to be effective in removing most indoor air contaminants. In the process of reacting with chemicals indoors, ozone can produce other chemicals that themselves can be irritating and corrosive.

Recommendations

The most proven methods to control indoor air pollution in commercial buildings involve source control, ventilation, and filtration. These methods involve eliminating or controlling pollutant sources, increasing outdoor air ventilation, and using proven methods of air cleaning.