

The following is a synopsis of an EPA report. The full text can be found at <http://www.epa.gov/iaq/pubs/ozonegen.html>



OZONE GENERATORS THAT ARE SOLD AS AIR CLEANERS

An Assessment of Effectiveness and Health Consequences

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.** Because of these claims, and because ozone can cause health problems at high concentrations, several federal government agencies have worked in consultation with the U.S. Environmental Protection Agency to produce this public information document.

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. Healthy people, as well as those with respiratory difficulty, can experience breathing problems when exposed to ozone. Exercise during exposure to ozone causes a greater amount of ozone to be inhaled, and increases the risk of harmful respiratory effects.

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.**

Health Effects	Risk Factors	Health Standards*
Potential risk of experiencing: Decreases in lung function Aggravation of asthma Throat irritation and cough Chest pain and shortness of breath Inflammation of lung tissue Higher susceptibility to respiratory infection	Factors expected to increase risk and severity of health effects are: Increase in ozone air concentration Greater duration of exposure for some health effects Activities that raise the breathing rate (e.g., exercise) Certain pre-existing lung diseases (e.g., asthma)	The Food and Drug Administration (FDA) requires ozone output of indoor medical devices to be no more than 0.05 ppm. The Occupational Safety and Health Administration (OSHA) requires that workers not be exposed to an average concentration of more than 0.10 ppm for 8 hours. The National Institute of Occupational Safety and Health (NIOSH) recommends an upper limit of 0.10 ppm, not to be exceeded at any time. The Environmental Protection Agency (EPA)s National Ambient Air Quality Standard for ozone is a maximum 8 hour average outdoor concentration of 0.08 ppm.
(* ppm = parts per million)		

IS THERE SUCH A THING AS "GOOD OZONE" AND "BAD OZONE"?

. Whether pure or mixed with other chemicals, ozone can be harmful to health.

ARE OZONE GENERATORS EFFECTIVE IN CONTROLLING 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.

- Ozone generators are not effective in removing carbon monoxide. For many of the chemicals with

which ozone does readily react, the reaction can form a variety of harmful or irritating by-products. However, in the process, the reaction produced a variety of aldehydes, and the total concentration of organic chemicals in the air. (Weschler, et. al., 1992b). In addition to aldehydes, ozone may also increase indoor concentrations of formic acid. Ozone does not remove particles (e.g., dust and pollen) from the air, including the particles that cause most allergies. 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.

There is evidence to show that at concentrations that do not exceed public health standards, ozone is not effective at removing many odor-causing chemicals.

- Body odor may be masked by the smell of ozone but is not removed by ozone. Ozone is not considered useful for odor removal in building ventilation systems.

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.

- 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.

Even at high concentrations, ozone may have no effect on biological contaminants. It is unlikely to fully decontaminate the air unless concentrations are high enough to be a health concern if people are present. Even with high levels of ozone, contaminants embedded in porous material may not be affected at all.

IF I FOLLOW MANUFACTURERS DIRECTIONS, CAN I BE HARMED?

Results of some controlled studies show that concentrations of ozone considerably higher than these standards are possible even when a user follows the manufacturers operating instructions. 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.

- None of the studies involved the simultaneous use of more than one device. The simultaneous use of multiple devices increases the total ozone output and therefore greatly increases the risk of excessive ozone exposure.

WHY IS IT DIFFICULT TO CONTROL OZONE EXPOSURE WITH AN OZONE GENERATOR?

Ozone generators typically provide a control setting by which the ozone output can be adjusted. The ozone output of these devices is usually **not** proportional to the control setting. While the smell of ozone may indicate that the concentration is too high, lack of odor does not guarantee that levels are safe.

CAN OZONE BE USED IN UNOCCUPIED SPACES?

Ozone can adversely affect indoor plants, and damage materials such as rubber, electrical wire coatings, and fabrics and art work containing susceptible dyes and pigments (U.S. EPA, 1996a).

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 manufacturers 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.

RECOMMENDATION

The public is advised to use proven methods of controlling indoor air pollution. These methods include eliminating or controlling pollutant sources, increasing outdoor air ventilation, and using proven methods of air cleaning.