



## Ozone Generators What You Need to Know

Many people who want to improve the quality of the air inside of their homes are unknowingly making it worse by using air purifiers that intentionally produce ozone, also called ozone generators.

**The Connecticut Department of Public Health (CT DPH) recommends that ozone generators not be used in the home.** Ozone is a gas that can cause health problems, including respiratory tract irritation, breathing difficulty, asthma exacerbation, and chest pain.

### **What are ozone-generating air purifiers?**

Some indoor “air purifiers” emit ozone, a major component of outdoor smog, either intentionally or as a by-product of their design. **Those that intentionally emit ozone are often called “ozone generators,” and are the focus of this fact sheet.**

### **What is ozone?**

Ozone, or O<sub>3</sub>, is a molecule made from three oxygen atoms. The three oxygen atoms form an unstable toxic gas that is highly reactive with other gases in the air. Ground level ozone is a major component of smog. Ozone found high up in the atmosphere, called stratospheric ozone, protects us by shielding us from harmful ultraviolet (UV) light. This “high in the sky” ozone and its beneficial effects should not be confused with the harmful “low to the ground” ozone, or smog.

### **What are some code words for ozone?**

Manufacturers of air purifiers sometimes use words like “activated oxygen,” “super oxygen,” “trivalent oxygen,” “allotropic oxygen,” “saturated oxygen,” “mountain-fresh air,” or “energized oxygen” when talking about ozone. These words give readers a false picture, by implying that ozone is a “healthy kind of oxygen.” *This is untrue.*

### **What are some of the health effects from exposure to ozone?**

Ozone is very harmful to the lungs. Exposure to ozone can make breathing difficult, inflame the lungs and lining of the respiratory tract, lead to permanent lung damage, and make it harder for the body to fight respiratory diseases. Symptoms to watch for include coughing, shortness of breath, and chest tightness/chest pain. In asthmatics, it can trigger asthma attacks and worsen symptoms. In people already in poor health, repeated exposure to high levels of ozone can increase the risk of dying.

## Are ozone-generating air purifiers effective at cleaning the air?

**NO.** Ozone is not effective at cleaning the air except at extremely high, unsafe levels, and then it is only partially effective. Devices that emit ozone at or below health standards set by the US Food & Drug Administration (FDA) do not effectively remove particles such as dust and pollen from the air, nor do they kill bacteria, viruses, mold, or other biological contaminants, despite claims made by advertisers. Further, if bacteria and/or mold are imbedded inside of porous materials such as carpet fibers or furniture cushions, ozone at or below health standards will have no effect on these biological contaminants.

Ozone is not effective at removing odor, but instead, can deaden the sense of smell. Being unable to detect odor removes our natural warning property for exposure to high levels of ozone.

Besides being harmful to people and animals, ozone can also damage furnishings made from certain plastics and rubber materials.

## How can ozone generators increase indoor air pollution?

Ozone does not remove chemical contaminants from the air, but in fact, increases chemical air pollution by combining with chemicals typically found in the home, office, or school, such as ordinary household cleaners, plug-in type air fresheners, and personal hygiene products. Many of these products contain a class of volatile organic compounds (VOCs) called terpenes, which are the fragrance component of pine and citrus oils. Ozone combines with terpenes to form dangerous reaction products (including formaldehyde, [a known human carcinogen and respiratory tract irritant]) which may be even more irritating than the parent chemicals.

## How much ozone do ozone generators produce?

There are a number of studies that have been performed to evaluate ozone output from air purifiers. In one study conducted by the U.S. Environmental Protection Agency (EPA), researchers ran an ozone generator in a test home at its maximum setting. When air from the room was sampled, ozone concentrations were found to exceed 0.3 parts per million (ppm). Air concentrations in an adjacent room exceeded 0.2 ppm. These levels are equal to a stage one smog alert – this is when local air pollution control districts advise the public to avoid some outdoor activities for health reasons. At the machine's medium setting, even with the home's central fan turned on, ozone concentrations in the rooms that were measured still exceeded the EPA outdoor standard of 0.08 ppm averaged over 8 hrs, as well the California outdoor standard for ozone of 0.07 ppm averaged over 8 hrs. There are no ozone standards for indoor air, except for FDA standards, which were written for medical devices. The FDA standard is 0.05 ppm.

### What Ozone Emitted from Ozone Generators DOES NOT Do at FDA Approved Concentrations:

- o Purify the air
- o Kill bacteria, viruses or mold
- o Remove smoke, dust, or other particulates
- o Remove odors

### What Ozone Emitted from Ozone Generators DOES:

- o Produces unsafe levels of ozone
- o Combines with other household chemicals to form dangerous reaction products that can be inhaled.
- o Increases the total number of chemical compounds (VOCs) indoors where ozone generators are used.
- o Damages certain plastics and rubber materials
- o Masks the odor of other indoor air pollutants by deadening the sense of smell.

## Why is it safe to use ozone to purify water, but not air?

Ozone can be used successfully to purify water in some applications. This is because very high levels of ozone can be used in water, and the reactions are taking place under water, where people are not generally exposed.

The amount of ozone emitted from devices that purify the air need to remain very low in order to avoid creating lung damage in exposed individuals. Such levels are not high enough to kill microorganisms in the air.

## Why are ozone generators still on the market?

While a handful of state and federal agencies have taken actions in an attempt to address this health issue, no agency has clear authority to control ozone emissions from air cleaning/purifying devices, and actions to date have not been effective in addressing this problem.

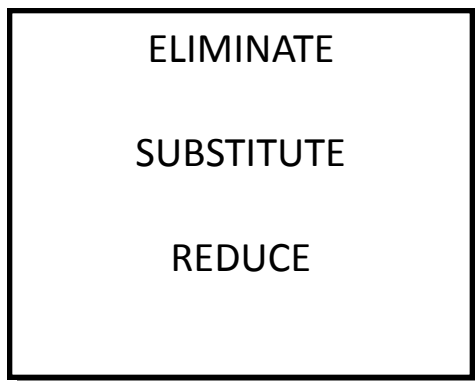
## Are there other types of air purifiers that produce ozone?

Ionizers and electrostatic precipitators (ESPs) are other types of air purifiers that produce ozone as a by-product of their design and function. These devices are designed to electrically charge particles and remove them from the air. Ozone is released through the charging process. These devices typically emit less ozone than ozone generators, so they are less of a concern.

Some of the newest models of air purifiers are hybrids and have become popular among consumers. These hybrids may incorporate multiple technologies, including ozone generators. Some add an ultraviolet (UV) lamp (advertised as "germicidal") and/or charcoal filters (for odor adsorption). Hybrid units may provide options to select different modes of operation with various combinations of switches/dials. For example, it might be possible to choose from several power settings on the ionizer, ESP or ozone generator portion of the machine, and on/off for the UV lamp. There may be a mode to select "ozone blast". **Selecting such a mode increases one's exposure to ozone gas. DPH advises against the use of hybrid devices containing ozone generators.**

## How can I safely remove pollutants from indoor air?

The best way to remove pollutants from indoor air is through source control. For example, try not to use odorous products indoors; substitute low or no odor products in their place; move activities that generate dust and other particles outdoors or to an area with a dedicated exhaust; do not smoke indoors. Add additional supply **air** (dilution ventilation) if needed.



## **Are there any situations when air purifiers may be beneficial?**

There is very limited scientific evidence in this area, leading scientists to state that the health benefits are unclear. It is very clear, however, that the use of air purifiers that intentionally produce ozone is hazardous and should be avoided. Ozone generators cause indoor air pollution, and they do not clean the air.

If someone living in the home has asthma or severe allergies, after ensuring that common environmental triggers have been removed, it may be useful to *filter the air*. Homeowners who have a forced hot air heating system may want to upgrade their furnace filters if they are currently using a simple, thin, disposable fiberglass filter. Replacing these with a pleated (fine mesh) filter or with a high efficiency air filter (HEPA) will greatly reduce the amount of particulates introduced into the circulating air stream from the outdoors. Upgrading the filter type can greatly improve indoor air quality (IAQ) in the home. Always check with the company that services your furnace before upgrading your filters, to be sure that the furnace motor can handle the increased resistance from the new filter type.

In homes that do not have forced hot air heating systems, other ways to filter the air include purchasing stand-alone (portable) filtration units. Choosing HEPA filtration units will provide the most efficient particulate removal. If it is necessary to remove odors, the unit should include some type of adsorbent filter. Activated charcoal filters are the most popular. To figure out what size filtration unit to purchase, the Association of Home Appliance Manufacturers (AHAM) has developed some materials to educate consumers about the Clean Air Delivery Rate (CADR). The CADR is a performance standard that measures the appliance's ability to reduce smoke, dust, and pollen particles from the air.

After the pollution sources are removed, if it is still felt that an air purifier is needed, there are a number of types from which to choose. A good overview is presented in the California Air Resources Board's [\*Air Cleaning Devices for the Home: Frequently Asked Questions\*](#).

## **Where can I find more information?**

Connecticut Department of Public Health  
Environmental and Occupational Health Assessment Program  
860-509-7740  
<http://www.ct.gov/dph/ieq>

*Hazardous Ozone—Generating “Air—Purifiers”*  
California Air Resources Board  
<http://www.arb.ca.gov/research/indoor/ozone.htm>

*Air Cleaning Devices for the Home: Frequently Asked Questions*  
California Air Resources Board  
<http://www.arb.ca.gov/research/indoor/acdsumm.pdf>

*Ozone Generators That Are Sold as Air Cleaners*  
U.S. Environmental Protection Agency  
<http://www.epa.gov/iaq/pubs/ozonegen.html>

Association of Home Appliance Manufacturers  
800-267-3138  
<http://cadr.org/consumer/index.html>