

DEPARTMENT OF HEALTH SERVICES

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IAQ FACT SHEET:

Health Hazards of Ozone-generating Air Cleaning Devices

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Ozone-generating devices are being marketed to the public as a solution to indoor quality problems. Ozone generators are available in three forms: in-duct units for central air systems, portable indoor units, and personal units that are worn on the body. They are promoted as effective “air purifiers”, especially to people sensitive to indoor air pollutants. Manufacturers often refer to the ozone as *activated oxygen*, *trivalent oxygen* or *nature’s air purifier* to suggest that it is safe. They advertise ozone’s ability to oxidize indoor air pollutants and “leave only carbon dioxide, water, and breathable oxygen.” However, independent studies have shown that ozone generators do not effectively destroy microbes, remove odor sources, or reduce indoor pollutants enough to provide any health benefits. More alarming, these devices can generate excessive levels of ozone and may contribute to eye and nose irritation or other respiratory health problems for users.

Health Hazards of Ground-Level Ozone

Ozone in the upper atmosphere (or stratospheric ozone) is naturally occurring and environmentally beneficial; it shields the Earth's surface from the sun's harmful ultraviolet light. It is important not to confuse this with the fact that ozone in the Earth's lower atmosphere, where we live and breathe, is a harmful air pollutant. Ground-level ozone is regulated by Federal and State Clean Air legislation. The California Ambient Air Quality Standard for ozone is 90 parts per billion (ppb) averaged over one hour. The Federal regulation is in transition; a new standard of 80 ppb for 8 hours is being phased in to replace the existing 1 hour standard of 120 ppb.

The State and Federal standards are supported by documented health effects of ozone measured in human and animal studies; these are summarized in a number of government reports^{1,2,3}. Exposures to ozone concentrations can cause various health effects^{4,5}:

- Moderate levels can irritate the eyes, nose, throat, and lungs.
- Low-level exposures have been shown to cause significant temporary decreases in lung capacity in healthy, exercising adults.
- Some asthmatic individuals are especially susceptible to ozone toxicity, which includes constricting airways.
- Short-term exposures can cause increased sensitivity to airborne allergens and other irritants, and it can impair the body’s immune system.
- Summertime ozone episodes in the northeastern U.S. lead to 10-20% increases in hospital admissions and emergency room visits.

- Human population studies of long-term exposures to low-level ozone indicate that it may lead to permanent reduction in lung capacity; animal studies have shown chronic high-level exposures can cause lasting structural damage in the lungs.
- Children, especially asthmatics, are most at risk from exposure to ozone.

Are Ozone-Generating Air Cleaners Safe and Effective?

The permissible exposure limit for ozone in the workplace is 100 ppb for 8 hours⁶. The U.S. Food and Drug Administration (FDA) has set the limit for ozone produced by medical devices at 50 ppb. Ozone is often used in water to kill microbes. However, it is not effective in air as a biocide (i.e. killer of bacteria and fungi), except at extremely high, unsafe levels⁷ (e.g. more than 3000 ppb). Ozone's effectiveness to oxidize chemical air pollutants "to leave only carbon dioxide, water, and breathable oxygen" is also unproven. A number of independent studies have concluded that safe levels of ozone do not effectively oxidize air pollutants or improve indoor air quality^{8,9,10}. Over the last 20 years, billions of dollars have been spent in this country to reduce levels of smog and its main ingredient, ozone. Ironically, ozone generators are being marketed heavily as a means to "purify" indoor air.

An even greater concern about the use of ozone generators is that they can readily produce unsafe ozone levels in the rooms they are used. Numerous studies on commercial and residential units have found that the devices produce room concentrations far in excess of the FDA, worker, and outdoor air standards^{11,12,13,14}. While most units on the market can produce dangerous levels of ozone, few include controllers to prevent ozone levels from exceeding safe limits. Some new models have "ozone sensors", but their effectiveness has not been independently evaluated. Ozone gas initially produces a sharp odor, however it dulls the sense of smell after a brief period of continuous use. Hence, perceived odor is not a reliable indicator of ozone's presence.

Questions often arise whether ozone air cleaners are appropriate for use in unoccupied spaces. They are sometimes promoted to treat homes, furniture, and clothing after fires to remove smoke odors. Ozone is a strong oxidizer that will accelerate the degradation of rubber, upholstery, paints, and other materials. Hence, even when used in unoccupied areas, ozone generators can cause damage to building materials and electronic devices.

Recent Actions

The California Department of Health Services (DHS) issued a warning about ozone air cleaning devices in April 1997¹⁵. In recent years, Minnesota, North Carolina, and Florida have taken a variety of actions to prevent public health hazards from ozone generators in their states. On December 30, 1997, the Federal Trade Commission (FTC) filed suit against the industry's leading manufacturer (Alpine Industries, Inc.) for violating their 1995 consent order with FTC¹⁶. The 1995 order required that ozone generator manufacturers halt their practice of making unsupported, misleading health claims about the ability of their products to remove indoor air pollutants and prevent or relieve allergies, asthma and other conditions. In addition, the manufacturers had been required to stop making unsupported claims that their devices are

more effective than other air cleaning methods and that they do not create harmful by-products. The current FTC action alleges that Alpine Industries has continued these practices. Related complaints can be directed to the FTC¹⁷.

Safer, More Effective Air Cleaners Are Available

The best way to resolve indoor air quality problems is to remove the pollutant sources or prevent emissions in the first place. Improving fresh-air ventilation is also beneficial. When an air cleaner is needed, safe, more effective models are available that can remove air contaminants without the health risks caused by ozone. These devices can use high efficiency particle arrestance (HEPA) filters, activated carbon, electrostatic precipitators, and/or particle ionizers (Note: precipitators and ionizers can generate low levels of ozone). Evaluations of household air cleaners have been published by the *Consumers Report*¹⁴, the American Lung Association (ALA)¹⁸ and U.S. Environmental Protection Agency (EPA)¹⁹. The former two reports give explicit warnings against ozone-generating devices. The *Consumer Reports'* authors conclude, after performing tests, that they "wouldn't recommend an ozone generator even as a last resort."

Information on California DHS' Indoor Air Quality Program can be found at the following web site:
<http://www.cal-iaq.org>.

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