

What are the adverse health effects from exposure to ozone?

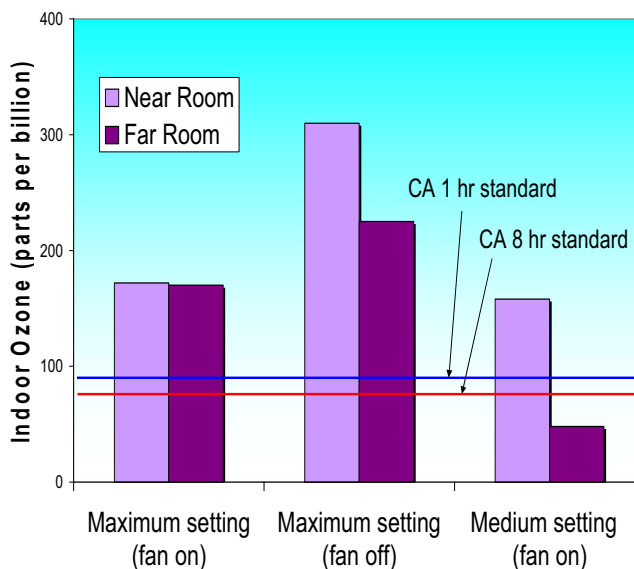
Buyers of ozone generators may not be aware that ozone can harm the cells in the lungs and respiratory airways. Exposure to ozone irritates and inflames the lining of the respiratory system. It causes symptoms including coughing, chest tightness, and shortness of breath. In persons with asthma, ozone can worsen asthma symptoms, and one study indicates that ozone may contribute to the development of asthma. Ozone impairs breathing. Elevated exposures to ozone can cause permanent lung damage, and repeated exposure can even increase the risk of dying among persons already in poor health.



Persons especially vulnerable include children and those who suffer from asthma or other respiratory diseases, including the elderly. Due to the health hazards of ozone, California has worked aggressively for decades to reduce outdoor ozone levels, with considerable success. For more information on the health effects of ozone, visit <http://www.arb.ca.gov/research/aaqs/caaqs/ozone/ozone.htm>. In addition to its impacts on health, ozone can also damage materials such as rubber, fabrics, plastics and other indoor furnishings.

How much ozone do ozone generators produce?

Studies have shown that ozone generators can produce indoor ozone levels several times the state outdoor health standard of 90 parts per billion (ppb) for one hour, as well as the eight hour standard of 70 ppb. In one experiment, a level of 300 ppb was measured in a house after 1-2 hours of ozone generator use.¹ As shown, indoor ozone levels were about twice the health standard levels when the ozone generator was set on the maximum setting and the central fan was either on or off. Ozone levels were almost twice the health standard levels in the near room even when the device was set to a medium setting. These concentrations are equal to, or worse than, a first stage smog alert. It is clear that the ozone concentrations produced by these devices can easily exceed health-protective standards.



Are ozone generators effective at cleaning air?

Some devices are marketed with advertising claims that they will kill viruses, bacteria, mold and other biological contaminants, and remove chemical contaminants and odors. However, studies have shown that, when ozone concentrations are below the health standards, it does not effectively remove biological contaminants. Ozone also does not remove particles (e.g. dust and pollen) from the air, including the particles responsible for most allergies. Research also shows that ozone generated by air purifiers does little to remove chemical pollutants. In fact, ozone has been found to react with existing chemicals in the air to create other toxic pollutants, most notably formaldehyde and ultrafine particles.

Some consumers purchase air purifiers to eradicate odors. Evidence shows that ozone concentrations below the health standards are not effective in removing many odor-causing chemicals. Ozone is also known to deaden one's sense of smell. Not only does this disguise rather than eliminate odors, it can also have the dangerous effect of decreasing a person's ability to detect high ozone levels.

Unlike the situation in air, ozone can be used successfully to purify water in some applications. This is so because high levels of ozone can be used in the water, most of the ozone reacts in the water, and people typically are not present when the ozone is used.

Why are ozone generators still on the market?

If ozone generators are ineffective at removing air pollutants, and they pose major health risks to users, why do they continue to be sold? The unfortunate answer is that misleading advertising by manufacturers is very effective, and no government agency has the authority to fully regulate these devices. Thus, ARB is actively working to educate professionals and the public about the dangers of using ozone generators.

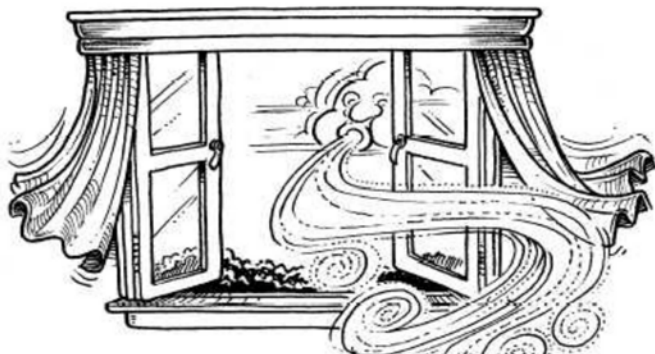
What does the Air Resources Board recommend?

We strongly advise against the use of ozone generators in occupied spaces. Other governmental agencies agree with this advice.^{2,3} A current list of ozone generators is available at: <http://www.arb.ca.gov/research/indoor/o3g-list.htm>.

Instead of using an air cleaner, consumers are encouraged to first eliminate or reduce indoor pollution sources and to ventilate well with outdoor air. The most effective method of controlling indoor air pollution is through prevention: eliminating pollution at its source. To minimize the release of pollutants indoors:

- carefully follow directions on consumer products such as cleaning agents, paints, and glues;
- properly maintain and operate gas- and wood-burning appliances;
- restrict smoking to outdoor areas;
- purchase building materials and wood furniture that do not emit formaldehyde;
- use candles and incense sparingly, if at all; and
- clean frequently and thoroughly to prevent dust and mold build-up.





Use plenty of ventilation: be sure there is adequate airflow to/from the outdoors. This can be achieved by opening windows, using exhaust fans near pollutant sources (e.g. above gas stoves), and increasing airflow through the use of mechanical ventilation systems. If your home is equipped with a central forced air system, you should also consider upgrading the filter.

If I still need an air cleaner, how do I find a good one?

In some cases, air cleaners may be beneficial. Types of air cleaners include filters (including High Efficiency Particulate Air or “HEPA” filters), electrostatic precipitators, ionizers, and hybrid models. For help in selecting a good air cleaner, see our Fact Sheet entitled “Air Cleaning Devices for the Home – Frequently Asked Questions,” February 2005, available by calling the telephone number shown below, or online at: <http://www.arb.ca.gov/research/indoor/aircleaners.htm>. Additional information can be obtained by reviewing rankings of effectiveness published by manufacturers (see the Association of Home Appliance Manufacturers website at <http://www.cadr.org>, and reports by other reviewers such as Consumers Union (<http://www.consumerreports.org>).

For more information: California Air Resources Board
 Research Division
 Indoor Air Quality Program
 P. O. Box 2815
 Sacramento, CA 95812
(916) 322-8282 (indoor information message line)

Indoor air quality guidelines are available at:
<http://www.arb.ca.gov/research/indoor/indoor.htm>

If you would like to receive periodic updates and information about air cleaners and indoor air quality, please sign up for our email list serve at: <http://www.arb.ca.gov/listserv/listserv.php>.

¹ Mason, MA *et al.*, (2000), “Characterization of ozone emissions from air cleaners equipped with ozone generators and sensor and feedback control circuitry.” In: Engineering Solutions to Indoor Air Quality Programs Symposium, Research Triangle Park, NC. VIP-98, AWMA, July, pgs 254-269.

² U.S. Environmental Protection Agency (EPA; 2005), Fact Sheet: “Ozone Generators that are Sold as Air Cleaners: An Assessment of Effectiveness and Health Consequences.” (<http://www.epa.gov/iaq/pubs/ozonegen.html>).

³ California Department of Health Services, (1997), Press release: “State Issues Warning About Ozone Air Cleaning Devices.” April, #27-97, Sacramento. <http://www.applications.dhs.ca.gov/pressreleases/store/pressreleases/27-97.html>.

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Hazardous Ozone Generators Sold as Air Purifiers - Updated May 5, 2006

Some devices that are advertised as “air purifiers” or air cleaners purposely emit large amounts of ozone, the main component of smog! Not only are such ozone generators ineffective at cleaning indoor air, but breathing ozone poses serious health risks. The Air Resources Board recommends that ozone generators not be used.

The following is a partial list of portable ozone generators that are sold as air purifiers, primarily for residential use. Inclusion on this list is based on information available at the time of review. Exclusion from this list is not to be construed as endorsement by the California Air Resources Board. Ozone generators intended for commercial use, and in-duct systems or other non-portable devices, are not listed here but may generate potentially harmful levels of ozone.

This list (updated May 5, 2006) will be updated periodically as information becomes available.

Air-Zone (All models)

XT-120, XT-240, XT-400, XT-800

Airdow (ADA Electrotech Co., Ltd.)

ADA 388, ADA 311, ADA 703, 704, 705, 706, 708, 728, 729, 739

Alpine (Certain models)

Living Air Classic, XL-15, Living Air BreezeAT, LA1, LA2, Peak, Flair

Applied Ozone Systems (Most models)

CS-1, CS-2

APSNA - Air & Water Purification Systems North America (All models)

FA1, C3, BAT, F2

Aqua Sun Ozone International (Certain models)

202A, 308, 206-A, Kleenair 2500R, 217A, 2500, 100

Aran Aqua Pollution Control Systems

SS-Series Aranizers (SS-1, SS-3X, SS-4X, SS-6, SS-8, SS-10)
NS-Series Aranizers (NS-3, NS-5, NS-6, NS-8, NS-10)

Better Living

Sun Aire Air Purifier

BioTech Research

EdenPURE Area Air Purifier

Biozone (All models)

50, 102, 500, 1000, 2000, 3000, 4000, 5000

Breathe Pure (Merazon Health Products, Inc.)

QOZO-100, QOZO-500

Cliff Scott Enterprises (All models)

CSE 100, CSE 101

Codyson

CD-200, CD-100, CD-120, CD-210, CD-2120, CD-2200

Crystal Air (All models)

Pro (700, 3400-1), Multizone 280, Pro 420

Csonka (All models)

Original Air Care, Super Air Care, Pro Air Care

EcoQuest (Most models)

Fresh Air, Living Air Classic, Breeze AT, Flaire, Fresh Air To Go

Ecozone (Hong Kong)

H-50, XL-250 SH, TS-50, M10

Enaly (Most models)

OZX-A200B, OZX-A500B, OZX-A3500, OZX-A700

HealthWay Home Products, Inc.

Healthway Air Deodorizer

Jenesco (All models)

DC-12, PT101, PT101W, PT109, PT109W

King Air & Water Purification Corp.

1004A, 1004, 1004SP

Lenntech (All models)

Series 3000

LightningAir

LA-1XP/2500

Longevity Resources

ZipZone, EnviroPro (420, 700, 3400, 3600, 3600-5)

Matsutek Enterprises Co., Ltd.

ION737, AR-150, CA-320, CA-721

Merazon Health Products, Inc.

see Breathe Pure

Natural Air

Natural Air

Nature's Air (compare LightningAir, Spring Air) (Only model)

NA-2

Odatum (All models)

II

Ozone Environmental Technologies

Uvonair (1000, 3000, 5000)

Ozone Solutions (All models)

MZ-280, OMZ-420, OMZ-700, OMZ-1000, OUV-550, OMZ-2500

Peak Pure Air

Peak O3 Air Purifier

Prozone (All models)

The Prozone (Purifier), Whole House Twister, PZ6-AIR, Whole House Air & Surface Purifier

Pure 'n Natural (Certain models)

OZ-2000 (Odor Zapper), Sani-Mate AS-250-B

QCH Tradelink

Medi-Aire

Quantum Pure Aire

AccuAire, ALS-1500, ALS-3000, RMS-100, ClassicAire (CS-1000, CS-2000, CS-3500), XP-350

Queenaire Technologies, Inc.

QT Storm, QT Thunder, QT Thunder-24, QT Tornado, QT Cyclone, Newaire Plugin

Rain Fresh Air

RFA5000, RFA3500

RainbowAir (All models)

Newaire Plug In, Activator (250, 500, 1000)

SpringAir (Certain models)

CS-1, CS-2

Sun Aire

see Better Living

SurroundAir (Certain models)

Multi-Tech

Taoture International Enterprises, Inc. (Most models)

OZX-A200B, OZX-A500B

TriMed AirMedic

SBR-1, SBH-1, C12-1, C12-U1

Trump Electronic Company

TP-2, TP-3, TP-4, TP-6

Windchaser (Certain models)

IF-1, IF-2, IMC-1

Zontec

Perfect Air Plug-In, PA 100, PA 200, PA 300, O3 Air Purification System