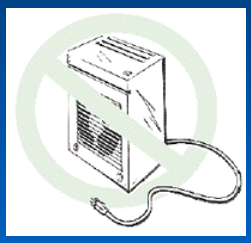
Health Update: Ozone Generators Sold as "Air Purifiers"



ARB Board Meeting

January 20, 2005

California Environmental Protection Agency
Air Resources Board

Thank you, Ms. Witherspoon, and good morning, Madam Chairman and members of the Board. This morning I will be discussing a growing public health concern regarding indoor air purifiers that purposely generate ozone.

What Are Ozone-generating "Air Purifiers"?

- Portable electronic appliances
- Some generate ozone by design: "ozone generators"
- Some generate ozone as a by-product
  - Ionizers
  - Electrostatic Precipitators (ESPs)

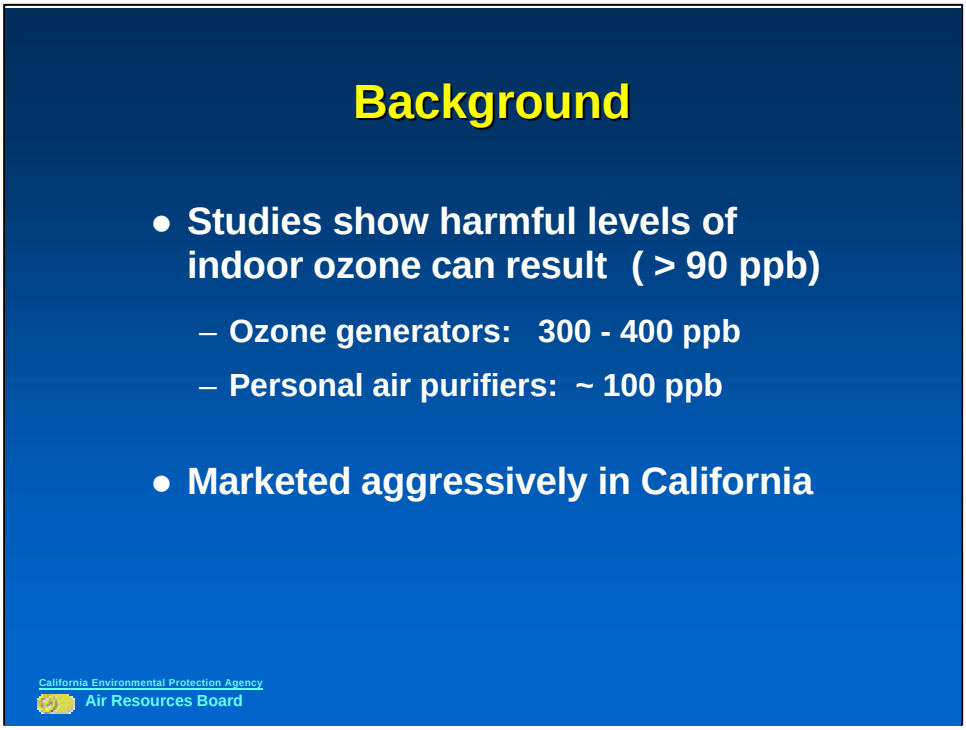
California Environmental Protection Agency
Air Resources Board

Ozone-generating "air purifiers" are portable appliances that purportedly remove indoor air pollutants by using an electronic technology.

There are two types of ozone-generating air purifiers, or air cleaners. First, some are designed to purposely emit ozone. The ozone is produced by electrical discharges or sparking. The amount of ozone produced varies by the size of the unit and the output settings on the unit. These devices typically do nothing more than generate ozone – they do not collect or trap particles or gases.

Some other types of electronic air cleaners generate ozone as a by-product of the technology they use to remove particles from the air. For example, ionizers produce negative ions that attach to particles in the room, causing them to deposit on the floor, walls, and other surfaces in the room. Electrostatic precipitators electrically charge particles, and then them trap them with oppositely charged plates inside the device.

Although a few studies have shown that some models of ionizers and electrostatic precipitators can sometimes emit ozone at elevated levels, our focus today is on ozone generators, or those that emit ozone purposely, because they appear to pose the greatest health risk. So, for the rest of this presentation, I will use the term "ozone generators" to refer to those devices that purposely emit ozone.



The public health community is concerned because research studies have shown that the use of ozone-generators can result in harmful levels of indoor ozone, that is, levels at or above our state standard of 90 parts per billion.

For example, ozone generators have produced over 300 parts per billion ozone in a test house within an hour or two of operation, and over 400 ppb in a chamber experiment.

Personal air purifiers, which are typically small ozone-generating devices carried on a strap around the user's neck, can produce 100 ppb of ozone near the user's face. We have an example of one of these personal air purifiers that I'll ask the Board secretary to pass to you. It is an earlier model that we tested in 1998. As you will notice, the ozone odor can be detected at the opening of the device within a minute or two after it is turned on.

These types of electronic air cleaners have been marketed aggressively for years, mostly by door-to-door, mail order, and internet sales methods. Newspaper, radio, and TV ads for some models have boomed in the last few years.

A Sample Ozone Generator Advertisement

The air purifier safely generates ozone to destroy household air pollution.

... Studies have proven that the air purifier can reduce airborne bacteria and fungus in an average size room in less than an hour.

Those suffering from allergies, sinus and other respiratory ailments have reported significant relief using the air purifier. ... in our opinion, the best air purifier on the market.

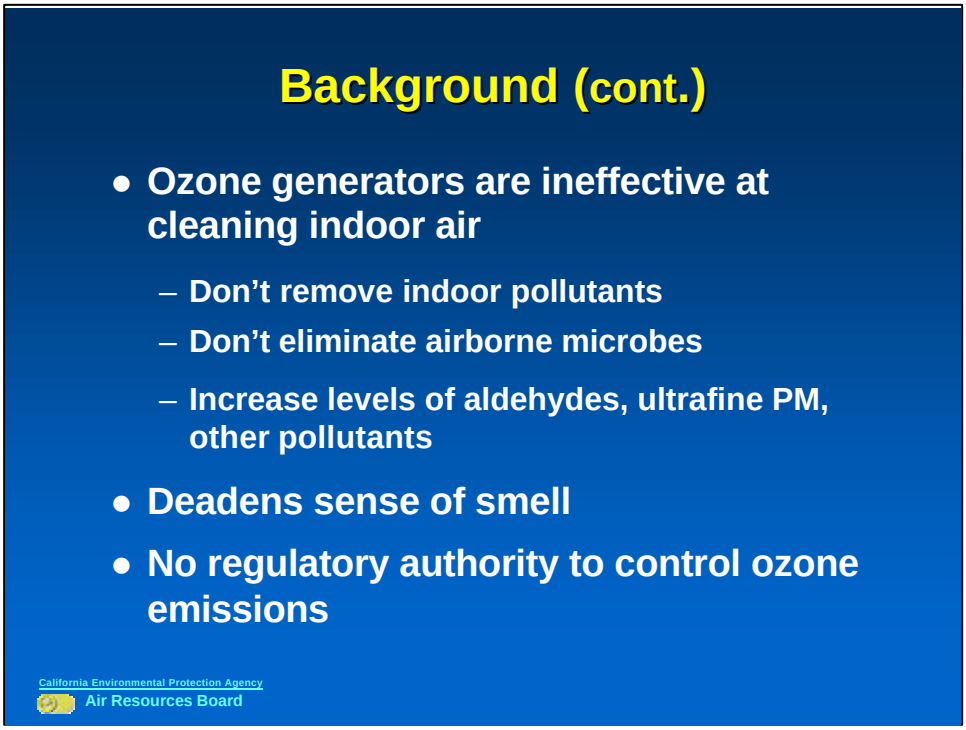
Ad Copy Taken 1-19-05 from:
http://www. biotechresearch.com/catalog/product_info. php?products_id=71

California Environmental Protection Agency
Air Resources Board

Here is a sample of the current ads for ozone generators that are used in marketing these devices. The ads often include claims that the devices can remove many types of indoor air pollutants, and they are often targeted at those people most susceptible to the ill effects of ozone, such as the elderly and those with asthma, who purchase these devices in hopes of improving their health.

The ads often use misleading terms such as “super-oxygenated”, “activated oxygen”, or “trivalent oxygen” when referring to the ozone that is emitted.

These ads and increasing concerns about indoor air quality have heightened consumer interest in indoor air cleaners in recent years. This interest is reflected in the large number of website hits for our fact sheet on residential air cleaners. That website received about 10,000 hits in 2002, 11,000 hits in 2003, and nearly 20,000 hits in 2004, nearly double the number of hits for each of the two previous years. Additionally, this website has been among the most popular of our health-related websites over the last few years.

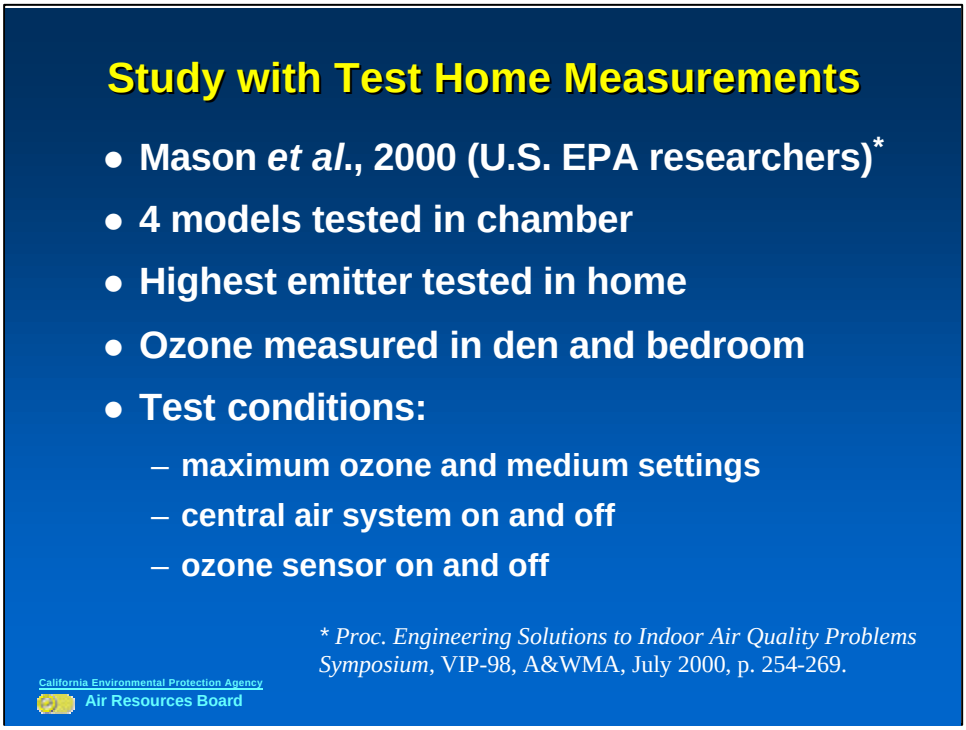


Despite the claims of manufacturers and distributors, ozone generators are ineffective at cleaning indoor air. Independent studies have shown that they do not remove particles, and only a few VOCs react and are removed. In contrast to ozone's effectiveness in purifying water for some applications, ozone cannot eliminate airborne bacteria, mold, or viruses in occupied spaces because very high levels of ozone – 5,000 ppb or more – are needed to kill them. Even if ozone generators are used in unoccupied places to generate high levels of ozone, the deadened cell parts remain and can trigger asthma and allergy symptoms in sensitive individuals.

In addition, ozone emitted indoors can lead to significant increases in the indoor levels of formaldehyde and other aldehydes, other VOCs, and ultrafine PM, through reaction with other chemicals present indoors. Some of these reaction products are listed as toxic air contaminants, and can irritate the mucous membranes and respiratory tract or cause other health impacts.

Ozone deadens the sense of smell, giving the occupants a false sense of security because they cannot detect any indoor odors, including elevated ozone levels.

Although the ozone generators can produce harmful levels of ozone, no state or federal agency has clear regulatory authority to limit indoor ozone emissions from air cleaners.



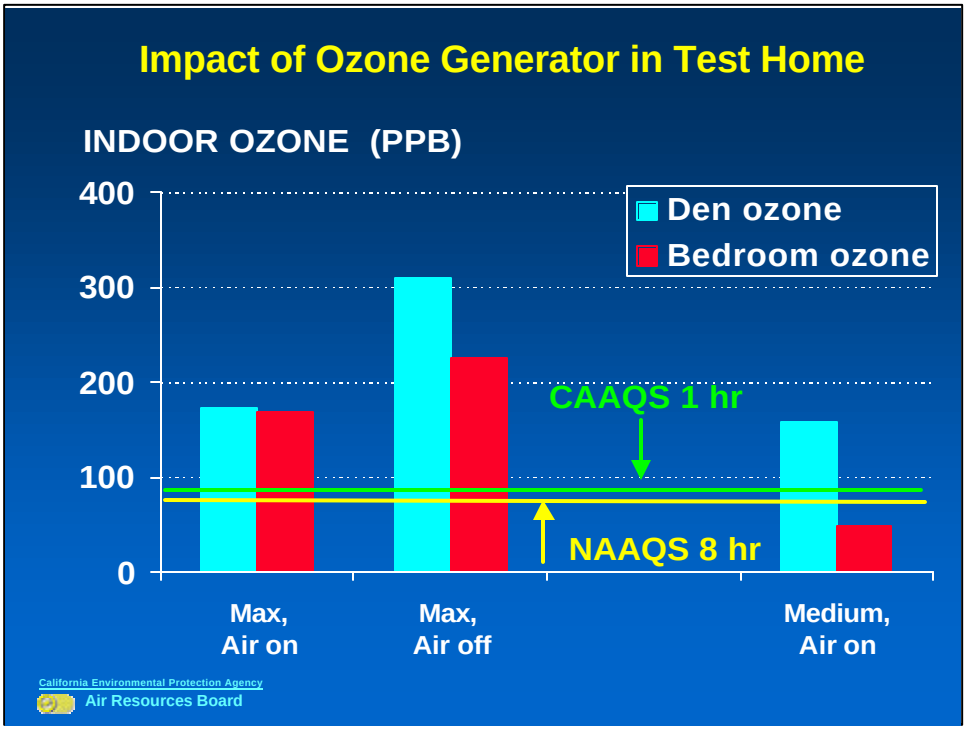
Most published information on emissions from ozone generators has been obtained from tests conducted in research chambers. However, in the study I'll discuss today, Dr. Mason and other researchers at U.S. EPA tested ozone generators in a test house, in addition to conducting chamber tests. This study is important because it confirmed that the conclusions drawn from earlier chamber studies hold true in real world settings.

First, the EPA investigators tested four models of ozone generators in the test chamber.

Then, they extensively tested the highest emitting model in the test house. The ozone generator was located in either the kitchen or den, and ozone levels were measured in the den and bedroom.

The ozone generator was tested under different conditions. First, the ozone output was set at either maximum or medium. Next, the home's central air system was set to either on or off.

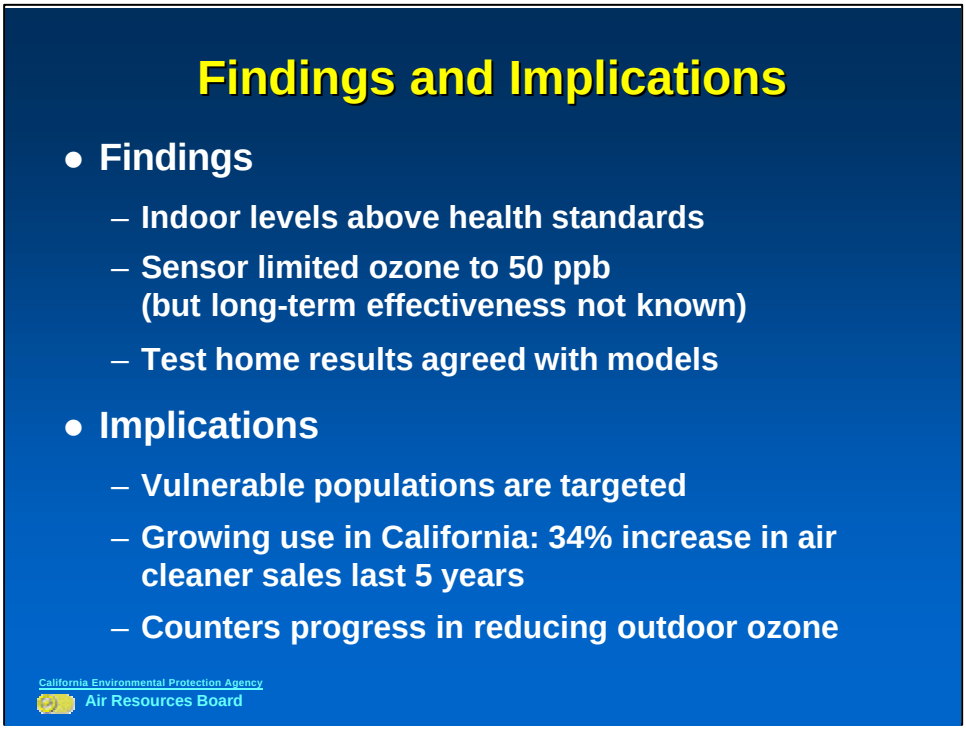
Finally, this unit had an ozone sensor designed to automatically shut the unit off when ozone levels of 50 parts per billion were detected, and this sensor was set to either on or off.



This graph summarizes the key test home results for the highest emitting ozone generator. Indoor levels of ozone after they reached a steady level are shown on the left axis, in parts per billion. The test conditions are shown on the bottom; the ozone sensor was turned off in the tests shown in this graph.

The two sets of bars on the left show the results when the unit was at the maximum ozone setting and located in the kitchen. The resulting indoor ozone levels in both the den and bedroom reached about 170 ppb, nearly twice the California ambient air quality standard of 90 ppb for one hour. When the central air was turned off, as seen in the middle set of bars, levels in the den reached 310 ppb, over 3 times the state standard, and 225 ppb in the bedroom.

The third set of bars, on the far right, show the results when the unit was located in the den, and operated at the medium ozone setting, with the central air on. As it shows, even at the medium setting with high air circulation and dilution, the den ozone levels still were nearly double the state standard level.



Dr. Mason's team concluded that the ozone generators they tested can generate steady-state, in-home levels of ozone that exceed standard levels that protect public health.

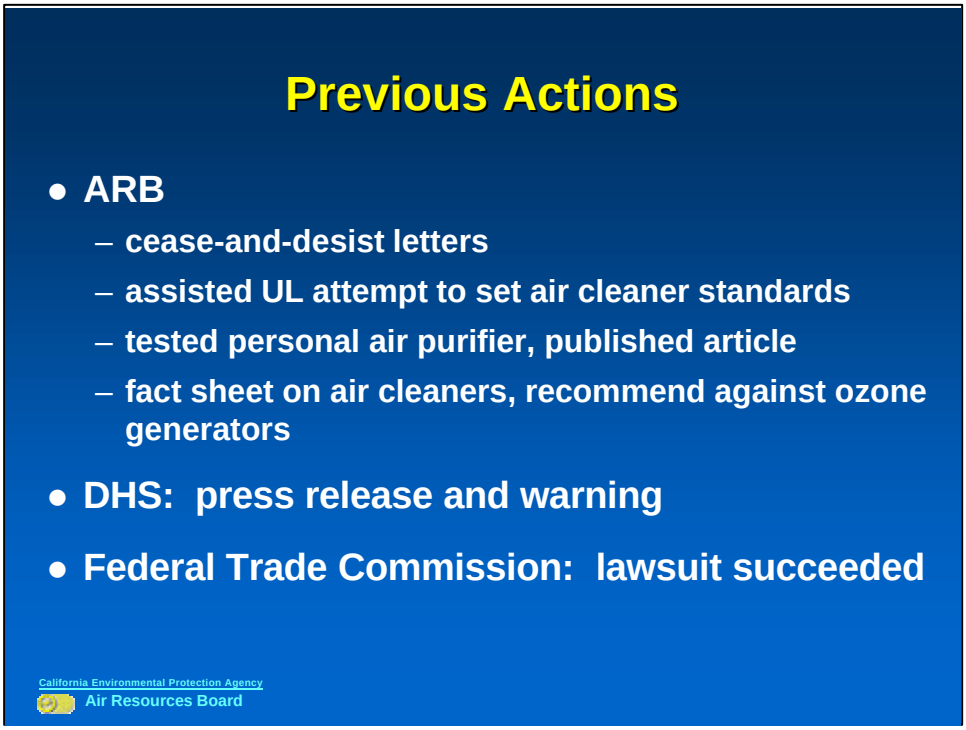
In other tests, they found that the ozone sensor on one model limited the indoor ozone levels to less than 50 ppb. However, very few models have such a sensor. Also, we remain concerned because their lifetime and long-term effectiveness have not been tested, and more importantly, on some models the sensors can be turned off by the user.

Finally, the Mason team found that the ozone levels measured in the test home agreed reasonably well with model estimates developed from results from the chamber tests, particularly at the higher ozone levels.

The results of this study and other studies of ozone generators have serious implications for public health.

Vulnerable populations such as persons with asthma or other respiratory diseases, and the elderly, are often targeted in the marketing for these devices.

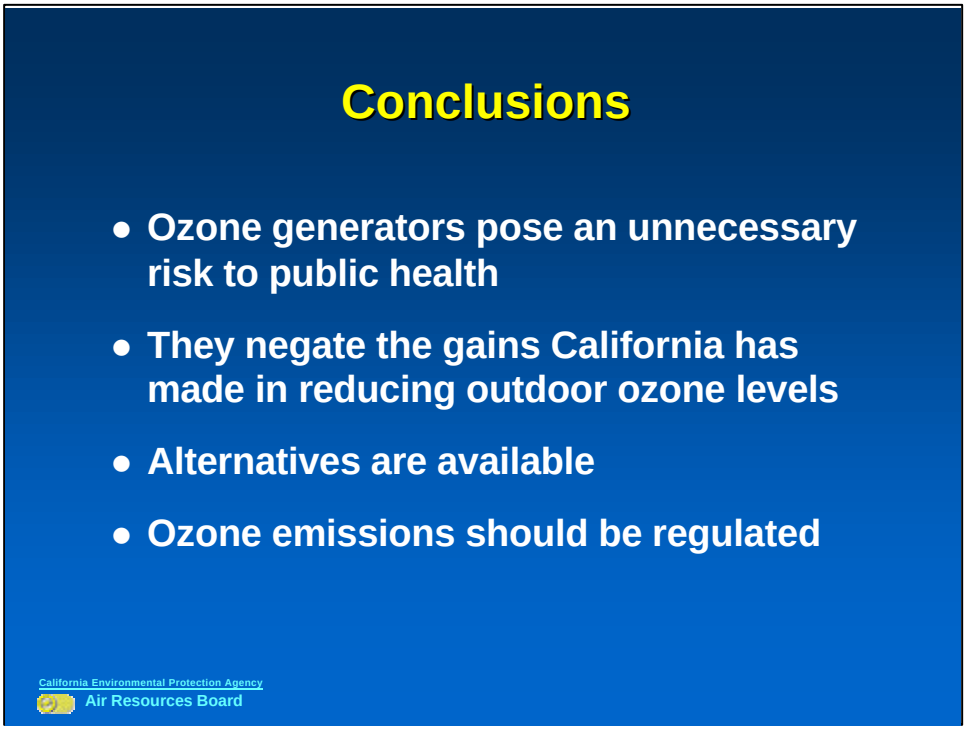
Additionally, the use of ozone-generators appears to be widespread and growing in California. Reliable sales data on ozone generators are not available. However, national market data indicate that the sale of all other types of portable air cleaners has grown by 34% in the past five years, and is expected to continue at this rate. This, plus the increased advertising noted earlier and the inquiries we receive from the public, raise our concern that these devices are negating the public health gains achieved in reducing outdoor ozone.



Several groups have taken actions to address ozone generators, but have not had any notable success. Starting in the mid-1990's, ARB staff sent letters to two manufacturers of ozone generators, asking them to halt the sale of their products in California. From 1996 to 1998, staff participated on a national task force initiated by Underwriters Laboratory to develop performance standards for portable air cleaners, but this effort failed, in part due to lack of industry cooperation. In 1998, we tested ozone concentrations produced by a popular personal air purifier, and published a journal article on our results. In 2000, we published a fact sheet on residential air cleaners in which we advise against using ozone generators and recommend other alternatives.

Others have taken some actions as well. In 1997, with input from ARB, the Department of Health Services issued a public health warning and press release that recommended against using ozone generators. U.S. EPA, Health Canada, and some other states have issued similar warnings.

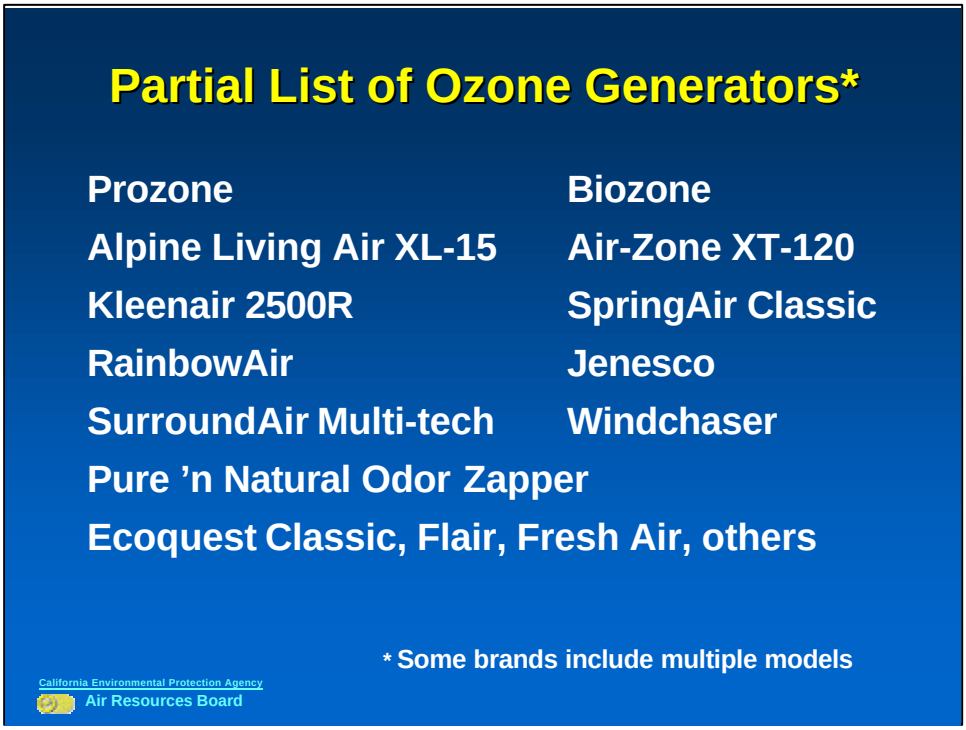
In 2000, the Federal Trade Commission successfully sued Alpine Air, a major manufacturer of ozone generators, for making false claims about the health benefits of their products.



Based on the available data, we conclude that ozone generators pose an unnecessary risk to Californians' health. Use of these devices can result in indoor ozone levels equal to a Stage 1 Smog alert, thus negating the health gains California has made by reducing outdoor ozone levels.

Additionally, alternative technologies for cleaning indoor air are available that are safe and effective. High efficiency particle attenuation, or HEPA, filters are especially effective for removing particles from the air.

Most importantly, we believe that ozone emissions from air cleaners should be regulated to protect public health. However, clear regulatory authority is needed to achieve this goal.



In this final slide, we have listed the names of some of the ozone generator brands and models that are currently on the market. Most of the brands listed have several ozone generator models available, including smaller models for use in boats, vehicles, bathrooms, or other special situations, or as personal air purifiers. We have not conducted an exhaustive search, but are aware of other brands and models that are currently marketed as well. We encourage consumers to use the information available on our website and that of others, such as the U.S. EPA, to help them select an effective and safe air cleaner.

That concludes my presentation. I will be happy to answer any questions you have.

For more ARB Health Updates please visit:

http://www.arb.ca.gov/research/health/healthup/healthup.htm