

FACTS ABOUT

Ozone emissions from consumer products and home appliances

Some consumer products and home appliances can emit ozone at high levels that may result in potential health effects, according to the results of a recent study conducted by ARB staff. Ozone is a reactive gas comprised of three oxygen atoms. It is a well-documented air pollutant that can be harmful to health when breathed. In this study, 17 consumer products and home appliances were tested that could emit ozone either intentionally or as a by-product of their functions. The results showed that six products in four categories emitted elevated levels of ozone, and five of these products emitted ozone at levels that may result in potential health effects. Some of them produced concentrations many times greater than the level of the 1-hr California Ambient Air Quality Standard (AAQS) for outdoor ozone (0.09 parts per million, or ppm). Despite short periods of use, some products can produce most of the ozone that a typical California resident may be exposed to in one day.

What types of products were tested for ozone emissions?

This study measured ozone emissions from three refrigerator air purifiers, two fruit and vegetable washers, two facial steamers, two shoe sanitizers, two drinking water treatment devices, one laundry water treatment system, two personal air purifiers, two ionic hair devices, and one sanitizing wand. These products were selected because they are advertised as producing ozone or have the potential to generate ozone based on their design.

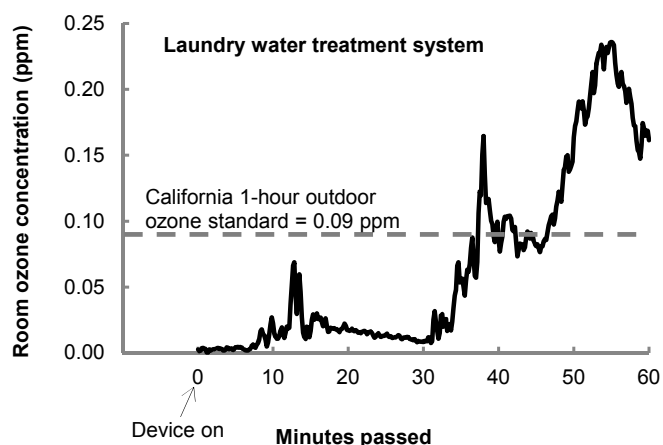


What types of products were found to emit ozone at potentially harmful levels?

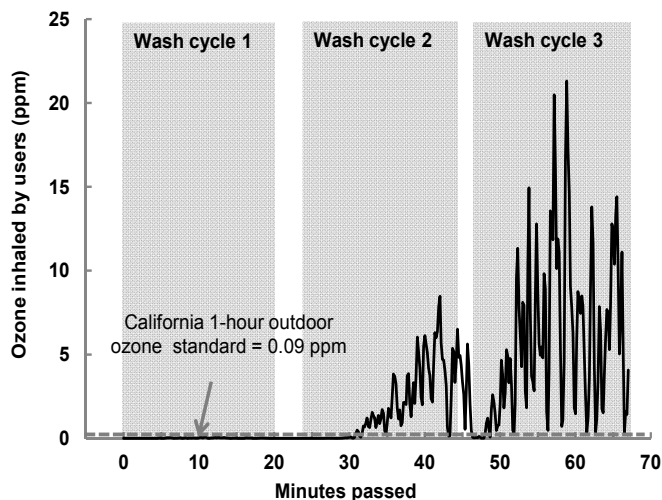
Five products emitted ozone at levels that may result in potential health effects, including the residential ozone laundry water treatment appliance, two fruit and vegetable washers, and two facial steamers. These products are designed to intentionally produce ozone.

How much ozone did these products emit?

Use of some products increased ozone concentrations in a small room to levels that exceeded the level of 1-hr California AAQS for outdoor ozone (0.09 ppm). The greatest increase of room ozone concentration over the period of one use was from the laundry water treatment system. This product is connected to the water inlet of a washing machine, and injects ozone into the water, which then flows into the washing machine. The figure on the right shows the time course of the room ozone concentration when this product was used for one wash cycle. The room ozone concentration gradually increased to levels above the level of the 1-hr California AAQS for outdoor ozone, and peaked at about 0.25 ppm. Due to users' close proximity to this product, the concentration of ozone that users actually inhale can be even higher. Additional testing showed that for one wash cycle, users may be exposed to an average of 0.42 ppm ozone, which accounts for about one-quarter to one-half of the ozone that a typical California resident may be exposed to in one day.



For some products, one use does not increase room ozone concentrations markedly, but repeated use can result in high exposure concentrations. The figure on the right shows the concentration of ozone very near the user when a fruit and vegetable washer was used for three continuous wash cycles with reused water. The average concentration over three wash cycles was 2.55 ppm, over 28 times higher than the level of the 1-hr California AAQS. In addition, users may be exposed to ozone peaks as high as 20 ppm for short periods. It was estimated that 30 minutes of use of this product can produce up to 80% of the ozone that a typical California resident may be exposed to in one day.



For the remaining products tested, their average ozone emissions were low, but surprisingly high spikes were commonly observed. For example, when using a facial steamer with ozone-emitting ultraviolet bulbs, peak ozone levels as high as 1.1 ppm were reached. Although the health effects of exposure to high levels of ozone for short periods have not been recognized, such exposures may raise a concern for sensitive populations, e.g., those with respiratory diseases who use these products repeatedly.

It should be noted that most of the products tested in this study are used intermittently; thus, their impacts on indoor air quality are limited to shorter time periods compared to continuously operating products such as ozone-generating portable air cleaners.

Why should I be concerned about ozone emitted by these products?

Ozone high in the atmosphere protects you from the sun's harmful rays, but at ground level, where you breathe, it can be harmful to your health. Within hours, ozone can irritate the lining of your respiratory system and can cause coughing, chest tightness and shortness of breath. Exposure to ozone may both induce and worsen asthma symptoms and worsen lung disease; it might also increase the risk of premature death. The effects depend on the concentration of ozone in the air, your level of physical activity, how long you are exposed to ozone, and how sensitive you are to it. Also, ozone can react with other chemicals, such as terpenes (fragrance chemicals that give a pine or citrus scent to some household products), to produce harmful byproducts such as formaldehyde and ultrafine particles. Ozone can also deteriorate materials such as rubber and elastomers, and cause certain sensitive dyes and artists' pigments to fade.

Due to its strong oxidative ability, ozone is widely advertised for odor removal and disinfection. However, the benefits of ozone-generating products as claimed by their manufacturers are not well supported. For example, to kill fungi and bacteria, ozone concentrations at least 5 ppm or higher are required, which is higher than the level that most appliances can produce and higher than is safe for health. Therefore, the benefits of using these appliances may be minimal, while the negative health impacts of such ozone exposures may be a serious concern.

What can I do to avoid exposure to ozone from consumer products?

Do not use products that emit ozone either intentionally or as a by-product of their functions. There are no consumer product regulations that limit ozone emissions from products similar to those tested by ARB, so consumers should exercise caution when purchasing or using such products. Read users' manuals carefully to determine if a product can emit ozone. Some manufacturers explicitly indicate their products emit ozone, but others may use different words for ozone, such as "super oxygen," "saturated oxygen," "activated oxygen," or similar phrasing. Avoid using intentional ozone generators, and be cautious about other products that have electrostatic precipitators, ionizers, plasma generators, or UV bulbs, because they have the potential to generate high levels

of ozone. For a list of high ozone-emitting products tested and similar products, visit www.arb.ca.gov/research/indoor/hazardousozoneproducts.htm. If you still want to use products that may emit ozone, only use them in a space that is not occupied by people and has proper ventilation.

What has ARB done to identify other ozone-emitting products?

Previous CARB studies found high levels of ozone emitted by intentional ozone generators that are marketed as air cleaners and other types of air cleaners such as ionizers and electrostatic precipitators. In September 2007, CARB adopted a regulation (California Code of Regulations, Title 17, §94800 - §94810) to limit the ozone emissions from indoor air cleaning devices to no more than 0.050 ppm. More information about this regulation can be found at www.arb.ca.gov/research/indoor/aircleaners/aircleaners.htm.

For more information

The journal article can be found at <http://onlinelibrary.wiley.com/doi/10.1111/ina.12307/pdf>. For more information about ozone, visit www.arb.ca.gov/research/aaqs/caaqs/ozone/ozone.htm, and for indoor air quality, visit www.arb.ca.gov/research/indoor/indoor.htm. You can also contact the ARB Public Information Office at (916) 322-2990, or ARB's Indoor Air Quality Program staff at (916) 445-0753 or (916) 322-8282 (message line) for additional information.

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