

GUIDANCE ON AIR CLEANING DEVICES FOR INDOOR SPACES

The COVID-19 pandemic has resulted in various businesses exploring options for improving indoor air quality. Improving ventilation by increasing the volume of fresh outdoor air along with reducing recirculated indoor air are key to improving air quality. Filtration and air cleaning are methods for reducing exposures to contaminants indoors and thus improving indoor air quality. Some air-cleaning technologies (also known as air purifiers) may harm health and may not be as effective as advertised. It is critical to make informed decisions when purchasing air purifiers. This informational fact sheet provides businesses with guidance to make prudent and informed decisions.

Strategies that have recently been implemented or considered include the use of air cleaners/purifiers. Many of these devices have unproven efficacies and can generate harmful secondary pollutants, such as ozone.

What are the different types of air cleaning technologies on the market?

Air cleaning devices are available as stand-alone portable appliances, as filters, or as devices installed in a building's heating, ventilation, and air conditioning (HVAC) system.

The following terms relate to the type of air cleaning technology used by a device:

- **Mechanical:** This type of air cleaner uses physical filtration, (designed to remove particles from the air through pleated or HEPA-style filters), and do not generate ozone or ions.
- **Ozone generating:** These units purposefully create ozone to clean the air through chemical interactions.
- **Electronic:** Air cleaners that work by charging particles in the air causing them to stick to surfaces in the room (e.g. ionizers, electrostatic precipitators, photocatalytic oxidizers, hydroxyl generators, devices with UV light components, and other electronic air cleaning technologies). Some machines that do not self-identify as ozone emitting do in fact emit ozone.

What type of air cleaners may emit ozone?

- Ozone generating devices are indoor air cleaners **that emit ozone by design.**
- Air cleaners that use electronic methods for air cleaning **but produce ozone unintentionally, as a by-product of their operation.** Any air-cleaning devices that are designed to electrically charge particles in the air during the air cleaning process have the potential to generate ozone. These devices typically produce ozone at a much lower rate than ozone-generating air cleaners. These can include devices that use bipolar ionization, plasma systems, portable air cleaning units with ionizers or devices using UV light components at the UV-V wavelength, and devices that generate reactive oxygen species such as hydroxyl radical generators.

Is it safe to use ozone generating air cleaner (indoor air cleaners that emit ozone by design)?

No. The U.S. Environmental Protection Agency (EPA) states that no devices have been approved in the U.S. for use in occupied spaces. Current state of the science regarding the health effects of ozone strongly suggests that the use of air cleaners that emit ozone by design should not be used in occupied spaces. When used at concentrations that do not exceed public health standards, ozone applied to indoor air does not effectively remove viruses, bacteria, mold, or other biological pollutants. Furthermore, ozone may even react with existing chemicals in the air to create harmful by-products (e.g. formaldehyde).

What harmful health effects can exposure to ozone cause?

Ozone can be harmful to your health. People most at risk from breathing air containing ozone include people with asthma, children, and older adults. Children (and teens) are at greatest risk from exposure to ozone because their lungs are still developing, and they breathe more air per pound of body weight than adults. Children are also more likely than adults to have asthma.

Ozone can cause the muscles in the airways to constrict, trapping air in the alveoli. This leads to wheezing and shortness of breath. Depending on the level of exposure, ozone can:

- Cause coughing and sore or scratchy throat.
- Make it more difficult to breathe deeply and vigorously and cause pain when taking a deep breath.
- Inflammate and damage the airways.
- Make the lungs more susceptible to infection.
- Aggravate lung diseases such as asthma, emphysema, and chronic bronchitis.
- Increase the frequency of asthma attacks.

Some of these effects have been found even in healthy people, but effects can be more serious in people with lung diseases such as asthma. Long-term exposure to ozone is linked to aggravation of asthma and is likely to be one of many causes of asthma development.

Are there any standards for ozone?

New Jersey does not have an indoor air standard for ozone. However, there are federal standards for outdoor emissions of ozone, indoor emissions of medical equipment, and occupational standards for workers (not applicable for schools).

- EPA's National Ambient Air Quality Standard for ozone is an 8-hour average outdoor concentration of 70 ppb.
- The Food and Drug Administration (FDA) requires ozone output of indoor medical devices to be no more than 50 ppb.
- The Occupational Safety and Health Administration (OSHA) has a personal exposure limit of 100 ppb for 8 hours for adults in the workplace. This level cannot be applied to children or the general public.

Note: California requires that electronic air cleaners must be tested for ozone emissions and meet an ozone emission concentration limit 50 ppb.

Is it safe to use air cleaning devices that may emit ozone as a byproduct of their operation?

Caution is warranted when using devices that emit ozone as a by-product of their operation. Even air cleaners that emit a negligible amount of ozone can be potentially hazardous to health. Elevated ozone levels can occur if the device is not used in the appropriate-sized room. The size of the device plays a key role in the level of ozone emitted.

What should I do if my business has an electronic air cleaner that may emit ozone as a byproduct of its' operation?

- If you have an ionization unit that incorporates bipolar ionization technology, you should check to see if it has the Underwriters Laboratories Standard Certification 2998 (UL2998) which validates the device for zero ozone emissions.
- If you have another type of electronic unit (or if you have an ionization unit without UL2998 certification) you should contact the manufacturer to determine whether your unit emits ozone and at what levels.
- If your unit emits ozone or you cannot confirm whether your unit emits ozone you should conduct indoor air sampling. There are instruments available to assist in identifying and monitoring ozone in real-time and over an entire school day. Please be sure to choose instruments that provides adequate sensitivity to measure ozone at low levels.

Is there scientific consensus that electronic air cleaners are effective in reducing airborne pathogens and indoor air contaminants?

It is critical to note there is no scientific consensus on the effectiveness of all the electronic technologies that claim to reduce virus concentrations under normal building conditions. Convincing scientifically-rigorous, peer-reviewed studies do not currently exist on some of these technologies therefore the manufacturer's data should be carefully reviewed. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) maintains the position that all filtration and air-cleaning technologies should be accompanied by data documenting their performance regarding the removal of airborne contaminants and these data should be based on established industry test standards. If this data is not available, scientifically controlled, independent third-party evaluation and documentation should be provided.

What can businesses do to improve indoor air quality?

There are many steps that can be taken to improve indoor air quality. Information on how to improve ventilation in indoor spaces can be found here: [Tips to Improve Indoor Ventilation](#)

Where can I get more information?

California Air Resources Board

- Air Cleaner Information for Consumers: <https://ww2.arb.ca.gov/our-work/programs/air-cleaners-ozone-products/air-cleaner-information-consumers>
- Hazardous Ozone-Generating Air Purifiers: <https://ww2.arb.ca.gov/our-work/programs/air-cleaners-ozone-products/hazardous-ozone-generating-air-purifiers>
- Complying with the Air Cleaner Regulation: Frequently Asked Questions: <https://ww2.arb.ca.gov/resources/fact-sheets/complying-air-cleaner-regulation>

US Environmental Protection Agency

- Ozone Generators That Are Sold as Air Cleaners: An Assessment of Effectiveness and Health Consequences: <https://www.epa.gov/indoor-air-quality-iaq/ozone-generators-are-sold-air-cleaners>
- Will an Ozone Generator protect me and my family from COVID-19?: <https://www.epa.gov/coronavirus/will-ozone-generator-protect-me-and-my-family-covid-19>
- Health Risk and Exposure Assessment for Ozone: <https://www3.epa.gov/ttn/naaqs/standards/ozone/data/20140829healthrea.pdf>
- Fact sheet: Overview of EPA's updates to the air quality standards for ground-level ozone: https://www.epa.gov/sites/production/files/2015-10/documents/overview_of_2015_rule.pdf

ASHRAE Position Document on Filtration and Air

Cleaning: https://www.ashrae.org/file%20library/about/position%20documents/filtration-and-air-cleaning_pd.pdf

CDC: [Operational Strategy for K-12 Schools through Phased Prevention | CDC](#)

THE LANCET COVID-19 COMMISSION Designing infectious disease resilience into school buildings through improvements to ventilation and air filtration:

<https://static1.squarespace.com/static/5ef3652ab722df11fcb2ba5d/t/60a3d1251fcec67243e91119/1621348646314/Safe+Work+TF+Designing+infectious+disease+resilience+April+2021.pdf>