Indoor air purifiers that produce even small amounts of ozone may be risky for health

May 9 2006

In a small, poorly ventilated room, an indoor air purifier that produces even a few milligrams of ozone per hour can create an ozone level that exceeds public health standards, researchers at UC Irvine have found.

Scientists also discovered that ozone produced by air purifiers adds to ozone already present in any room -- a prediction that had never been experimentally verified in a realistic indoor environment.

"These results mean that people operating air purifiers indoors are more prone to being exposed to ozone levels in excess of public health standards," said Sergey A. Nizkorodov, a chemistry professor in the School of Physical Sciences at UCI.

Nizkorodov and UCI chemistry students Nicole Britigan and Ahmad Alshawa published their research in the current issue of the Journal of the Air & Waste Management Association. Their findings will be studied by officials deciding how to regulate the distribution of indoor air purifiers.

California lawmakers are considering legislation that would require the California Air Resources Board to adopt regulations to reduce emissions from indoor air cleaners by 2008. The state board and the U.S. Environmental Protection Agency have issued advisories discouraging use of air purifiers, but the devices remain on the market because no agency has the outright authority to regulate how much ozone they produce.

Indoor air purification has gained widespread popularity with the surge in air pollution problems in urban areas.

Air purifiers target dust, pollen, airborne particles and volatile organic compounds, which are emitted by a wide range of products, including paint, cleaning supplies and pesticides. These pollutants are believed to aggravate respiratory and other health problems.

Indoor air purifiers are advertised as safe household products for health-conscious people -- especially those who suffer from allergies and asthma -- but some purifiers produce ozone during operation. For example, certain widely used ionic air purifiers, which work by charging airborne particles and electrostatically attracting them to metal electrodes, emit ozone as a byproduct of ionization.

Depending on the design, some ionic purifiers emit a few milligrams of ozone per hour, which is roughly equal to the amount emitted by a dry-process photocopier during continuous operation.

Ozone can damage the lungs, causing chest pain, coughing, shortness of breath and throat irritation. It can also worsen chronic respiratory diseases such as asthma and compromise the ability of the body to fight respiratory infections -- even in healthy people.

For this study, the research group tested several types of air purifiers for their ability to produce ozone at 40 percent to 50 percent relative humidity in various indoor environments, including offices, bathrooms, bedrooms and cars.

Placed inside a room, the air purifier was turned on, and the ozone concentration buildup was tracked until a steady level of ozone was reached. In many cases, indoor ozone levels far exceeded outdoor safety guidelines, which in California are 90 parts per billion for one hour and

70 parts per billion for eight hours.

The ozone level in some instances reached higher than 350 parts per billion -- more than enough to trigger a Stage 2 smog alert if similar levels were detected outside. A Stage 2 alert last occurred in the Southern California coastal air basin in 1988.

Of the spaces tested, the largest increase in steady ozone levels occurred in small rooms with little ventilation, especially those containing materials that react slowly with ozone such as glossy ceramic tile, PVC tile and polyethylene, which is used in plastic. Ozone reacts quicker with materials such as carpet, cloth, rubber and certain metals, destroying itself in the process.

People who operate purifiers indoors are more likely to be exposed to ozone levels that exceed health standards because ozone from these devices adds to ozone that already exists in the room.

Said Nizkorodov: "If 30 parts per billion of ozone exist in the room because dirty outside air is leaking into the house, turning on an air purifier that generates 50 parts per billion of ozone creates a total ozone level of 80 parts per billion."

Source: University of California - Irvine