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CR INVESTIGATES

New concerns about ionizing air cleaners

Buying an air cleaner that doesn't clean the air is bad enough. Some of the least effective ionizer models also can expose you to potentially harmful ozone levels, especially if you're among the roughly 80 percent of buyers with asthma or allergy concerns.

Also known as electrostatic precipitators, the five ionizing air cleaners we focused on for this report are supposed to trap charged particles on oppositely charged plates. But as we reported in October 2003, models like Sharper Image's Ionic Breeze, the market leader, did a poor job removing dust and smoke from the air. Our latest tests also show that some ionizing models can expose you to significant amounts of ozone.

Unlike ozone in the upper atmosphere, which helps shield us from harmful ultraviolet rays, ozone near ground level is an irritant that can aggravate asthma and decrease lung function. Air cleaners need not meet ozone limits—not for the federal Environmental Protection Agency, which regulates only outdoor air, nor for the Food and Drug Administration, since it doesn't consider them medical devices, despite the health benefits that some ads imply. (See CloseUp, page 24.) Manufacturers often submit air cleaners to a voluntary standard that includes a test to see whether they produce more than 50 parts per billion (ppb) of ozone, the same limit the FDA uses for medical devices.

We replicated that test using the sealed polyethylene room specified by Underwriters Laboratories Standard 867 to help ensure consistent results. Ozone levels were measured 2 inches from each machine's air discharge in accordance with the standard. All five ionizers failed the test by producing more than the 50-ppb limit—in some cases, much more.

People don't live in sealed plastic rooms, however. So we also tested these ionizing air cleaners in an open, well-ventilated lab. For comparison, we also tested a top-performing Friedrich electrostatic-precipitator and a Whirlpool HEPA model from previous reports.

We measured ozone levels 2 inches from the machines, as in the sealed-room test, and 3 feet away, since ozone becomes diluted and dissipates rapidly indoors as it reacts with carpet, upholstery, and other surfaces. In our lab tests, two ionizing models—the IonizAir P4620 and the Surround Air XJ-2000—emitted more than 150 and 300 ppb, respectively, 2 inches from the machine.

While few people are likely to sit 2 inches from the air discharge, where our ozone readings were highest, you could be exposed to higher levels than those we measured at 3 feet if you take a cue from manufacturers. The IonizAir's box shows it on a desk near a keyboard and on a nightstand near a sleeping woman. The Ionic Pro CL-369 is shown next to a sofa, while the Surround Air's manual suggests placing it "nearby those suffering from breathing or other health problems."

Ozone from ionizing air cleaners is a greater concern as sales increase. Ionizers now account for about 25 percent of the roughly $410 million per year spent on air cleaners as brands such as Brookstone and Oreck compete. (We plan to test the Oreck in a future report.)

INDOOR OZONE HITS THE RADAR

Experts agree that an ozone concentration more than 80 ppb for eight hours or longer can cause coughing, wheezing, and chest pain while worsening asthma and deadening your sense of smell. It also raises sensitivity to pollen, mold, and other respiratory allergy triggers, and may cause permanent lung damage.

Most indoor ozone is carried inside with outdoor air. Regulators have given indoor ozone less attention than outdoor ozone, since dilution and dissipation typically lower indoor levels by 20 to 80

CR Quick Take

Months of testing and investigation yielded these findings:

- **Many ionizing air cleaners like the kind we tested do a poor job of removing particles from the air.**
- **Two separate tests—in a sealed room and in an open lab—show that some can create significant levels of ozone.**
- **Ozone is a growing concern. People with asthma and respiratory allergies are especially sensitive to it.**
- **Some ads include endorsements that mean little. (See CloseUp, page 24.)**
- **Consider low- or no-cost air-cleaning alternatives. (See CR Quick on page 25.)**

WHERE OZONE IS PRODUCED

Inside an ionizing air cleaner

Unlike HEPA air cleaners, shown at far right, ionizing air cleaners impart an electrical charge to the air, creating charged molecules known as ions, which are supposed to cling to airborne particles. Ionizing models that are also electrostatic precipitators, such as the kind we focused on for this report, add an oppositely charged collection plate designed to attract the particles. Ozone is produced as a byproduct when high voltage near the charging wires converts oxygen to ozone, which then exits the machine and flows into the room air.

ILLUSTRATIONS BY TREVOR JOHNSTON

percent. But Charles J. Weschler, professor of environmental and occupational health sciences at the Robert Wood Johnson Medical School in New Jersey, notes, "Since we spend so much time indoors, exposure is often greater than outdoors."

Recent studies of ozone's cumulative effects also raise concerns. A 14-year study of 95 urban areas in the U.S. found a clear link between small increases in ozone and higher death rates. The study looked at days when outdoor ozone concentrations didn't exceed the Environmental Protection Agency's 80-ppb standard over eight hours, according to the study's lead author, Michelle L. Bell, assistant professor of environmental health at Yale University's School of Forestry and Environmental Studies.

"We were able to tease out the relationship between ozone and mortality, even accounting for each day's weather and particulate pollution," Bell said in an interview. "A small increase in ozone was associated with a small increase in mortality and a larger increase with a larger increase in mortality, even in cities with low ozone levels." The study predicts that a 10-ppb increase in ozone over eight hours could lead to roughly 3,700 premature deaths per year in those cities.

CLOSE ENCOUNTERS
Images like this could prompt you to place some air cleaners near enough for you to breathe relatively high ozone levels in their air stream.

Another ozone study conducted in 2001 over six months in southern New England by the Yale University Center for Perinatal, Pediatric, and Environmental Epidemiology links ozone levels well below the EPA's 80-ppb standard to a higher risk of respiratory symptoms and use of rescue medication for children with severe asthma. Indeed, the study found ill effects even on days when ozone levels were 20 ppb lower than the EPA standard over eight hours.

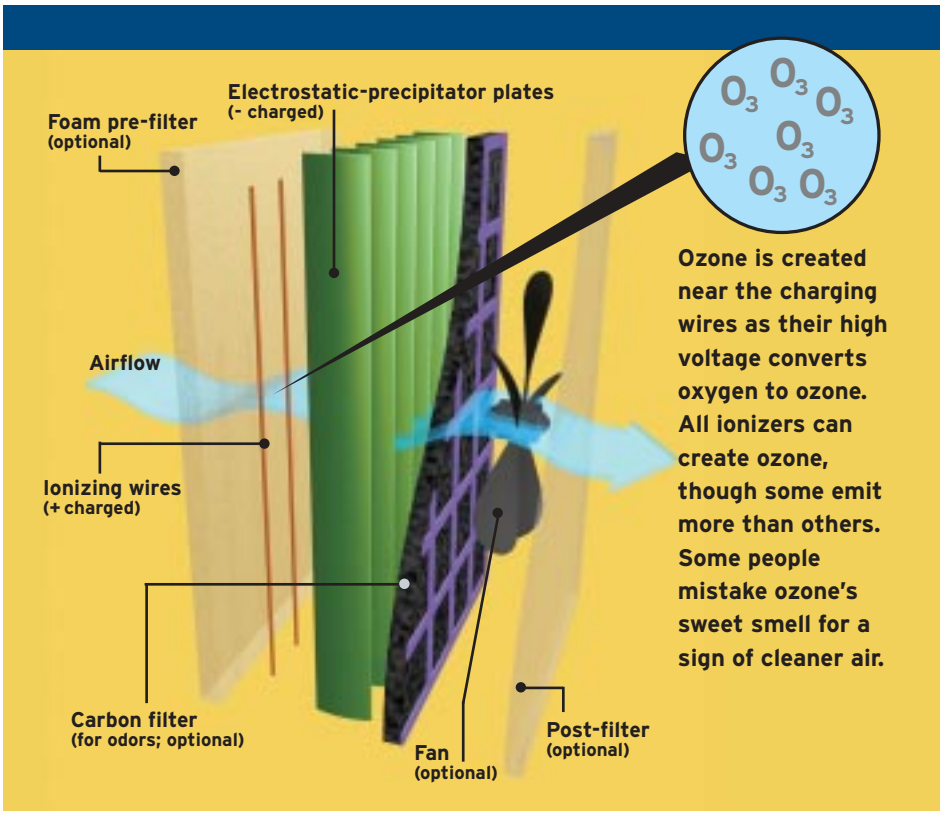
OZONE RAISES OTHER THREATS

While ozone dissipates indoors, it can create other pollutants in the process. Research suggests that ozone reacts with the terpenes in lemon- and pine-scented cleaning products and air fresheners, creating formaldehyde—a carcinogen—and other irritants. Those byproducts can be absorbed by beds and carpets, and be released over an extended time frame. Research has also found that ozone reacts with terpenes to create additional ultrafine particles, which are hard to filter and can go deep into lungs.

A REGULATORY BLACK HOLE

Ionizers such as the five we focused on are adding ozone indoors just as regulators work to cut ground-level ozone created outdoors as pollutants react with sunlight. The federal EPA's acceptable outdoor level is 80 ppb over eight hours. This year the California EPA recommended lowering the state's outdoor limit to 70 ppb. World Health Organization standards are tougher at 60 ppb over eight hours.

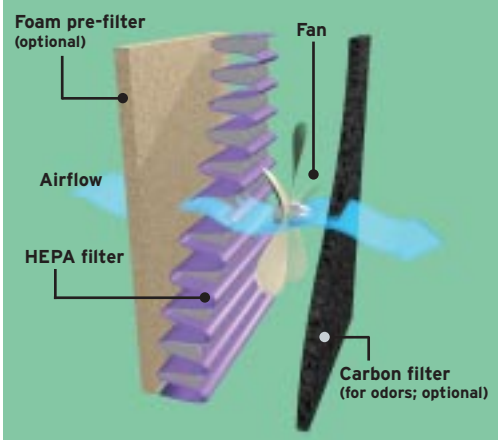
Several states, the EPA, and Canada have issued warnings about ozone gener-



Ozone is created near the charging wires as their high voltage converts oxygen to ozone. All ionizers can create ozone, though some emit more than others. Some people mistake ozone's sweet smell for a sign of cleaner air.

HOW MANY AIR CLEANERS OPERATE

Inside a HEPA air cleaner



Models with a high-efficiency particulate air (HEPA) filter are most common. Typically, a fan pulls air through a foam pre-filter designed to remove some larger particles. The air is then forced through the pleated HEPA filter, which is designed to trap most particles. The air may then pass through a carbon filter to remove odors.

closeup

AIR CLEANERS: THE TRUTH BEHIND THE ACCOLADES

Ads for air cleaners from Sharper Image and Oreck include a Seal of Truth from the Asthma and Allergy Foundation of America (AAFA), a Washington, D.C.-based group. Sharper Image ads also display a Seal of Approval from the British Allergy Foundation, now known as Allergy UK, and refer to university studies claimed to support Sharper Image's air-cleaner claims.

As we found, some university studies were funded by the manufacturer. We also found that another seal on some air cleaners addresses the volume of clean air those machines deliver, though it doesn't tell the whole story.

What seals don't tell you. The AAFA's Seal of Truth program is open to manufacturers who submit a $5,000 application fee. According to the AAFA, companies are asked to submit "independent" research for review by a panel of experts, who determine whether a product's performance meets its claims. If the panel says it does, manufacturers can apply the seal to that product for two years. Fewer than 12 allergy-related products, including vacuums and cleaning products, have the seal; Sharper Image's Ionic Breeze and Oreck's XL are the only air cleaners with it.

The AAFA states on its Web site that its expert panel includes M.D.s, Ph.D.s, and Masters of Public Health. Michael Tringale, an AAFA spokesman, would not identify its experts, citing confidentiality concerns. Nor would Tringale or Sharper Image show us research submitted as part of the seal program. But the AAFA's literature discloses two points that the air-cleaner ads don't mention.

One is that its seal is not an endorsement or statement of clinical efficacy. Yet the words on the seal for Sharper Image's Ionic Breeze, above, imply otherwise.

The other is that its program isn't a comparison but, rather, "helps consumers distinguish truthful product claims relating to asthma and allergies, regardless of how products compare to each other." In an interview, Tringale said that AAFA panel members saw a Consumer Reports air-cleaners report that found the Ionic Breeze ineffective, but granted the seal anyway. "Because we aren't rating in comparison," Tringale said, "we asked, does the research stand up? And indeed it did." But when Sharper Image submitted studies to Consumers Union, the nonprofit publisher of Consumer Reports, they didn't stand up.

NO ENDORSEMENT The AAFA says its Seal of Truth isn't an endorsement, but its laudatory tone suggests otherwise.

Allergy UK's Seal of Approval program is somewhat like the AAFA's, though it says its seal is an endorsement. A manufacturer submits a fee for new testing by an "independent scientific consultant" at the University College Worcester or a review of its own independent tests. According to the British group, a 39-member panel of experts sets specific protocols for each product.

Allergy UK would not disclose detailed information about its review protocol. What's more, the foundation states on its Web site that its endorsement does not mean that a product will necessarily reduce an allergy sufferer's symptoms.

Endorsement programs between business and nonprofit groups raise ethical concerns. A 1994 study commissioned by the American Cancer Society concluded that the use of its logo is seen as endorsement. In 1997 the American Medical Association withdrew from an agreement allowing its logo to be used on Sunbeam blood-pressure monitors and other devices amid conflict-of-interest concerns. That withdrawal resulted in a nearly $10 million breach-of-contract settlement with Sunbeam.

By 1999 such programs led 16 state attorneys general to issue a report warning that their implied product endorsements could "mislead, deceive or confuse the public." Such programs remain numerous. But some organizations acknowledge concerns. The American Lung Association says its national board comprises physicians and others who agree to its conflict-of-interest policy, which excludes directors from companies with which it has partnerships. At the time this report was written, the AAFA's Web site showed that its board included representatives of pharmaceutical, medical-device, and air-filter manufacturers.

What the studies don't say. Studies touted in Sharper Image ads came under scrutiny last year in the company's lawsuit against Consumers Union. Court testimony and documents revealed information absent from the ads. For one, documents showed that a researcher had been receiving a $6,000 monthly retainer from Sharper Image for research used by the company to support the sale of its Ionic Breeze. The company also provided research grants to a university professor and author of two reports about the Ionic Breeze prepared at Sharper Image's request, and compensated others whose research was cited.

One study was deemed irrelevant by Consumers Union because the Ionic Breeze was used as a particle collector, not as an air-cleaning device. To put that difference into perspective, you can collect the dust particles that settle out of the air and onto a tabletop in a room, but that doesn't make the table an air cleaner.

In November 2004 federal Judge Maxine Chesney dismissed Sharper Image's suit, holding that there was no reasonable probability that Consumers Union's findings were false and that Sharper Image's studies provided no basis for challenging those findings. (See Up Front, page 9.)

PRODUCT PLUG Allergy UK makes no bones about calling its seal an endorsement.

What's in the numbers. Many models, including the Friedrich and Whirlpool, have clean-air delivery-rate (CADR) certifications. Seals are issued by the Association of Home Appliance Manufacturers (AHAM). A manufacturer must submit its line to independent lab tests or have its results verified by an AHAM-designated lab. The seal lists CADR results and the room size that a model can effectively clean. It also notes that a higher CADR is better. While the numbers are a good guide to an air cleaner's effectiveness, you must check one of AHAM's Web sites *(www.cadr.org)* to compare models.

What's a good rating? You'll see numbers from 10 to 450. Generally, we judge CADR values above 350 excellent and those below 75 poor. Air cleaners with a CADR of 10 or less are barely distinguishable from gravity at removing airborne particles.

ators, a small segment of the air-cleaner market. While ionizers emit ozone as a byproduct, ozone generators create it by design and purport to offer health benefits. CONSUMER REPORTS found two such models Not Acceptable as early as 1992.

The Consumer Product Safety Commission is reviewing scientific and government data on all air cleaners that create ozone. The CPSC is also evaluating whether the 50-ppb industry standard is adequate protection for consumers, and it may recommend a lower limit. A report is expected later this year.

No federal agency sets indoor ozone limits for homes, however. The EPA has authority over ozone outdoors, not indoors, though it publishes booklets on indoor air quality and runs the Indoor Air Quality Information Clearinghouse. Interestingly, the EPA doesn't take a strong position for or against buying any air cleaner.

The Food and Drug Administration regulates medical devices but says air cleaners aren't covered because manufacturers make only vague, health-related claims, rather than claims related to specific diseases. Nonetheless, the 50-ppb ozone limit for medical devices is also the threshold used in the industry test.

Some manufacturers tacitly acknowledge that their ionizers create ozone and may pose risks. Brookstone's owner's manual suggests that "any person suffering from heart, lung, or respiratory illness should consult his or her physician before using this unit." But that advice is buried deep in the manual's text.

The bottom line: Consumers Union believes that the CPSC should set indoor ozone limits for all air cleaners and mandate performance tests and labels disclosing the results. CU also believes that the Federal Trade Commission should take a close look at air-cleaner ads to determine whether they include unsubstantiated and deceptive claims.

In the meantime, we recommend avoiding ionizers that performed poorly or emitted significant ozone in our tests. "We can't guarantee safety at any ozone level, so it makes sense not to contaminate your living space," says Jonathan Samet, M.D., chairman of the epidemiology department of the Johns Hopkins Bloomberg School of Public Health.

CR Quick Recommendations

Not all ionizing, electrostatic-precipitator models produce significant amounts of ozone. As shown in the Ratings, the Friedrich C-90A is effective and emits very little ozone, as does the HEPA-filter Whirlpool 45030. But those we don't recommend produced ozone and did a poor job cleaning the air. New tests confirm that pollen performance, which we haven't measured before, tracks with dust and smoke performance. If you already own one of the five poor-performing ionizers below, try returning it for a refund.

We advise thinking twice about buying any air cleaner before following a few simple, low- or no-cost cleaning methods. Here are some tips from the federal Environmental Protection Agency and the American Lung Association:

- Reduce indoor pollutants. Ban indoor smoking. Minimize candles, incense, and wood-burning fires, and use unscented cleaners. Wash linens in hot water. Keep dust-sensitive people out of the area when vacuuming. Also be sure to keep solvents and pesticides outdoors.
- Keep your home ventilated. Use outdoor-venting exhaust fans in kitchen, bath, and laundry areas to reduce moisture and airborne particles that can breed respiratory irritants. Maintain heating and cooling equipment, chimneys, and vents to minimize the presence of carbon monoxide in your living space.

If you buy an air cleaner, choose one that works (see the recommended models below). The Friedrich electrostatic precipitator and the Whirlpool HEPA model were also recommended in previous reports. We plan a full air-cleaner report later this year.

For ConsumerReports.org subscribers

For full Ratings of previously tested air cleaners that are still available, click on Appliances on the home page.

Ratings room air cleaners

- **Availability** Most models at stores through July 2005.

Excellent · Very good · Good · Fair · Poor

In performance order.

Brand & model	Price	Overall score (0–100; P F G VG E)	Annual cost	Dust	Smoke	Pollen	Noise	Passed UL ozone sealed-room test	Open-lab net ozone (ppb) 2 in.	Open-lab net ozone (ppb) 3 ft.
Similar models, in small type, comparable to tested model.										
RECOMMENDED *Fine performers with negligible ozone.*										
Friedrich C-90A [1]	$450		$127	Excellent	Very good	Excellent [3]	Fair	✔	5	4
Whirlpool 45030 [2]	250		194	Very good	Very good	Very good [3]	Fair	✔	2	1
NOT RECOMMENDED *Ionizing models with poor performance, some with relatively high ozone.*										
Brookstone Pure-Ion D v2 [1]	300		45	Poor	Poor	Poor	Good	X	26	2
Sharper Image Professional Series Ionic Breeze Quadra SI737 SNX [1]	400		7	Poor	Poor	Poor	Excellent	X	48	18
Ionic Pro CL-369 [1]	150		9	Poor	Poor	Poor	Excellent	X	33	10
IonizAir P4620 [1]	70		2	Poor	Poor	Poor	Excellent	X	168	28
Surround Air XJ-2000 [1]	80		2	Poor	Poor	Poor	Excellent	X	319	4

D *Discontinued, but similar model is available. Price is for similar model.* [1] *Electostatic precipitator.* [2] *HEPA-filter model.* [3] *Pollen performance based on AHAM- reported results.*

Guide to the Ratings

Overall score does not include ozone levels and is based on an air cleaner's ability to remove fine dust and cigarette-smoke particles from a test chamber, as well as on noise and ease of use (not shown). **Dust, smoke, and pollen** scores reflect the ability to clear air of those particles on the high setting. **Noise** is based on instrument measurements at high speed. **Passed UL ozone sealed-room test** reflects the polyethylene-room Underwriters Laboratories Standard 867 ozone test replicated for this report. Models with a check mark (✔) passed the test by remaining within the 50-parts-per-billion (ppb) threshold of ozone (measured from 2 inches) over 24 hours; models with an "X" failed by exceeding that level in these tests. **Open-lab net ozone** reflects ozone readings in an open, well-ventilated lab, both from 2 inches and from 3 feet from each unit's air discharge and within its air stream. **Annual cost** combines yearly energy and filter costs. **Price** is approximate retail.