

Gas Phase Filtration

A Guide to Understanding Gaseous Contaminant Air Filtration

“Something stinks in here!”

When a building has an odor control problem, you know it. But not all irritant gases – including volatile organic compounds (VOCs) – can be detected by smell alone. Fortunately, odors, VOCs and many harmful gaseous contaminants can be removed from the breathing air inside buildings with a combination of source control, proper ventilation and an effective gas phase air filtration system.



VOCs and Other Gaseous Contaminants

VOCs and other gaseous contaminants can be distracting and irritating to building occupants. Some VOCs and gases cause odors, but not all odors are noticeable or objectionable to everyone.

A variety of different VOCs may be in the indoor air at any one time. VOCs such as formaldehyde, methylene chloride, benzene, and perchloroethylene can come from many sources within a building: adhesives, carpeting, upholstery, manufactured wood products, paints, copy machines, pesticides, graphics and craft materials, dry-cleaned goods and cleaning products. These everyday items may release organic compounds into the air during use, and to some degree, when they are stored. Environmental tobacco smoke (ETS) also contributes high levels of VOC's as do unvented kerosene and gas space heaters, woodstoves, fireplaces and gas stoves, which can emit combustion products such as carbon monoxide and nitrogen dioxide.

Did You Know...

Volatile Organic Compounds (VOCs) are emitted as gases from certain solids or liquids. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. Elevated concentrations of VOCs can persist in the air long after use of the VOC-containing product is completed. No standards have been set for VOCs in non-industrial settings.

Source: U.S. Environmental Protection Agency

Health Effects of Gaseous Contaminants

Research shows that some VOCs can cause chronic and acute health effects at high concentrations, and some are known carcinogens. Low to moderate levels of multiple VOCs may also produce acute reactions. Some VOCs may interact with other chemical compounds to form a third compound that also may be a threat to health and comfort (even if the concentration of individual VOCs may be well below odor thresholds or known toxic levels).

Health effects of VOCs may include:

- Eye, nose and throat irritation
- Headaches
- Loss of coordination
- Fatigue and dizziness
- Nausea
- Damage to liver, kidneys and central nervous system
- Allergic skin reaction

Source Control

The first step in reducing or eliminating VOCs and other gaseous contaminants is to identify the source, and if possible, remove it. When source removal isn't possible, exposures may be reduced by:

- Using sealants on all exposed surfaces of paneling and other furnishings.



- Adopting integrated pest management techniques to reduce the need for pesticides.
- Safely discarding partially full containers of old or unneeded chemicals.
- Purchasing limited quantities of hazardous materials if they are needed only occasionally or seasonally.
- Properly storing and disposing of food and other garbage.
- Allowing time for building materials in new or remodeled areas to off-gas pollutants before occupancy.
- Selecting or specifying low-emitting products and furnishings for your building.

Ventilation

The next step when using products that emit VOCs is to increase ventilation – essentially to diffuse or dilute the odors and gaseous molecules with fresh air from the outside. In some buildings, this may be as simple as using an exhaust fan or opening a window when working with potentially hazardous products.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has developed Standard 62-1989 “Ventilation for Acceptable Indoor Air Quality” designed to help buildings achieve acceptable IAQ. The standard calls for a minimum of 15 cubic feet per minute (cfm) (25.5 cubic meters per hour) of outside air per person (20 cfm/person in office spaces). When there are strong pollutant sources – in areas such as rest rooms, copy rooms, and printing facilities -- local exhaust ventilation may be appropriate to exhaust contaminated air directly from the building.

One issue with ventilation – especially in large commercial buildings – is the cost of energy required to heat or cool the outside air being drawn into the building.

Gas Phase Air Filtration

Air cleaning – through an effective gas phase air filtration system – is another way to remove gaseous contaminants from the breathing air. Most gas phase filtration systems use activated carbon to adsorb gaseous molecules.

Activated carbon is made from a variety of high carbon-content substances including coal, wood, coconut shells and bamboo. On a microscopic level, activated carbon looks and acts much like a natural sponge, with pores and a vast amount of surface area. As gaseous molecules come into contact with the carbon, they are drawn into the carbon and held into place by a variety of forces – similar to a magnetic or gravitational attraction.

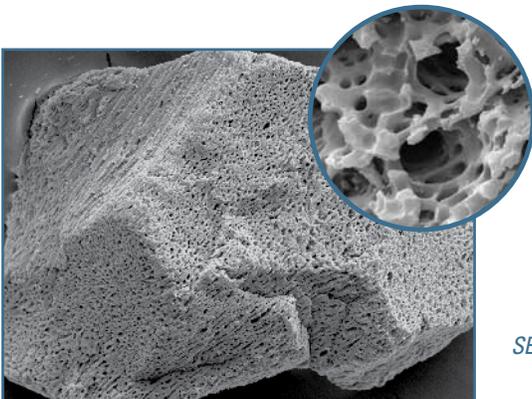
Did You Know...

HEPA (High Efficiency Particulate Air) filters, while providing up to 99.97% removal of particulate pollutants from indoor air, do nothing to remove gaseous pollutants.

Of all the adsorbents known, activated carbon is one of the strongest physical adsorbents, so it is an excellent material for creating superior indoor air quality by removing odors and other gases from the air.

When gaseous contaminant filtration is indicated, effective filtration systems employ a combination of particulate and gas phase filtration technologies. In two-stage HVAC filtration systems, particulate pre-filters in the MERV 7 to 8 range protect higher-efficiency final filters. In environments with significant gaseous contaminant levels, final filters may be replaced with granular bed or deep-pleat carbon filters.

In more typical scenarios, gaseous contaminant levels are low to moderate, and single-stage pleated gas phase filters may be used. These filters are more expensive than traditional pleated filters, but they remove the entire spectrum of airborne contaminants: particulates and gases. Be sure to select a filter that has a particulate filtration level of at least MERV 7.



SEM of Activated Carbon Particle



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