Texas Cooperative EXTENSION
The Texas A&M University System

Cleaning to Reduce Indoor Air Pollutants

Indoor air is often more contaminated than outdoor air. The contaminants are in the form of gases and fine particles. Household cleaning has little effect on gaseous pollutants, but it can affect the concentration of particles in the air. Fine particles include dust, smoke and other particulates that enter a dwelling from outside, as well as those that are generated inside.

Internal sources of particulate contamination are smoke and grease aerosol (airborne particles) from cooking and using self-cleaning ovens; mold and fungal growth from moisture and high humidity; allergens produced by pets, insects, and dust mites; toxic lead dust from peeling lead-based paint, and airborne dust from vacuuming and duct cleaning and some household cleaning products (Bode, 1997).

Some particulates , such as dirt, enter the house on shoes or pets. The outside dirt can be a carrier of pesticides, pollen, fungi, bacteria, animal feces and insect parts. These are deposited on the floor, where they are ground into small particles as they are walked on. The smallest particles are suspended in the air, while the larger ones settle back on the floor, where they are ground again.

Airborne particles can cause breathing problems and allergies in sensitive individuals and potential severe health problems for persons with asthma. Controlling the concentration of particulates through cleaning can help relieve symptoms and prevent disease.

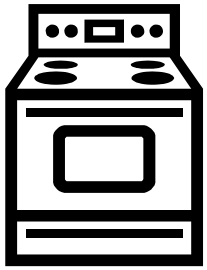
This publication identifies sources of particulate air pollution and means of reducing airborne particles in homes by using effective cleaning methods and other control strategies. Cigarette smoke and pollen are not covered, because household cleaning may not affect their concentrations.

"Cleaning is defined as the activity of removing contaminants, pollutants, and undesired substances from an environment or surface to reduce damage or harm to human health or valuable materials" (Cole, 1999). The goal is to create a healthy indoor environment with a reduction of occupant exposures to pollutants and a corresponding decrease in human health risk.

The sources of indoor air pollution that will be identified are cooking, mold and mildew, vacuum cleaning, dust mites and animal dander, lead dust, air ducts, and household cleaning products.

Oven and Stove Top Cooking

Cooking generates heat, humidity and three types of aerosols: solid smoke particles, grease vapor that condenses into semi-liquid particles as it cools, and grease spatter particles from uncovered frying. The self-cleaning oven produces aerosol during the cleaning cycle, and significant amounts pass through the oven's smoke eliminator into the indoor air.



The best solution is to use an exhaust fan to divert moisture and some fraction of these particles before they become part of the room air. A vented range hood is more effective in exhausting moisture and particulates than a ceiling or wall fan because the hood is closer to the generation source. The most effective hood has an intake configuration that matches the range top, has the highest air flow consistent with a tolerable noise, and is set as close to the range top as permitted by the mechanics of cooking (stirring, viewing food, etc.). Any hood used with a gas range should not generate air currents that will distort the shape of the flame from each burner.

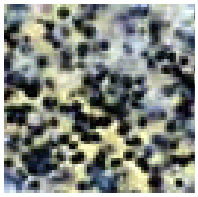
The disadvantage of a recirculating hood (vent) is that it must clean the air it captures before returning it to the room. It can be used if a vented hood is not possible, but it should have a series of effective filters - 1) a washable, aluminum-mesh filter to remove grease spatter particles; 2) a pleated, glass-fiber filter to remove smoke; and 3) an activated carbon filter to capture odor. ***This type vent hood does not remove any moisture that is released into the air during cooking.***

The self-cleaning mode of the oven should never be operated without the exhaust fan on.

Mold and Mildew

Mold spores are everywhere in our environment, both indoors and outdoors. If mold is allowed to "grow", it will generate spores that become airborne. If the conditions are conducive for mold growth, spores that settle on surfaces will generate new mold colonies. Some spores will remain suspended in the air. Removal of mold and mold spores to the extent possible provides for a more healthy home.

Moisture or high humidity level is required for mold growth (>60%RH).



There are thousands of types of mold. Some molds are toxic and others are not. There are many common places where molds grow. These include:

* Walls, floors, carpeting and on stored materials in damp basements and crawl spaces.
* Bathrooms without exhaust fans
* Laundry areas where dryers are not vented outside or clothes are hung to dry
* Homes with new construction materials
* Homes where there have been spills, leaks or other water damage.
* Homes where a humidifier or an unvented combustion heater is used.
* Air conditioning system oversized for area and therefore is not removing adequate humidity.

The solution is to control moisture. Repair all plumbing leaks. Reduce ***relative*** humidity levels in the home to no more than 50 %. If condensation forms on windows, the humidity needs to be reduced even further, maybe down to 30%. Reduce humidity with a dehumidifier, air conditioner or furnace. Increase the air flow to problem areas by using a fan or ventilation from the outside if the air is dry.

Use exhaust fans vented to the outside when taking baths or showers and when cooking. Vent clothes dryers to the outside. Do not use unvented kerosene or gas heaters. Do not store natural materials containing high levels of moisture, such as firewood, inside the house. Use a vapor barrier to reduce the outside moisture that enters a crawl space.

Keep surfaces clean and dry to remove existing mold colonies and to prevent mold colonies from starting. Hard surfaces that have mold growing on them should be cleaned with detergent and water, disinfected and then thoroughly dried.

One of the most effective, least expensive disinfectants is chlorine bleach (sodium hypochlorite). Products with an EPA registration number are reliable disinfectants and have instructions for disinfecting.

Appliances that collect or distribute water need to be cleaned and disinfected regularly to prevent mold growth. These include dehumidifiers, humidifiers, air conditioners and refrigerator drip pans.

It is necessary to be more cautious if a resident suspects a toxic mold. Stachybotrys atra is one potentially toxic mold. It requires "long-term water saturation of cellulose-based material such as paper, cardboard, wood, wallboard, or jute-backed carpet" (Bode, 1999). It is a greenish-black mold.

If an area larger than 30 feet square is affected with mold, a professional may need to do the clean-up. At the very least, a homeowner who decides to do the clean-up needs to wear protective goggles, mask, gloves and clothing. The person doing the clean-up needs to understand how to complete the clean-up without spreading the mold spores to other parts of the home. (See Texas Cooperative Extension Pub. L5425, "Mold: An Indoor Air Pollutant" for more detailed information).

Vacuum Cleaning

Dirt in a carpet or on a hard-surfaced floor is clusters of very fine particles. Cleaning the floor with a broom or vacuum disturbs the dirt particles and causes the smallest ones to become airborne. Vacuum cleaning can turn floor dirt into an air pollutant in two ways.

1. If the air from the vacuum discharges down, it disturbs settled dirt particles and causes them to become airborne. When the cleaner discharges down over a dirty carpet, research shows a 98% increase in household airborne dust concentration in the following two-hour period. An upright cleaner or horizontally-discharging canister cleaner does not disturb settled dirt particles in the air discharge.
2. The bag in the vacuum cleaner is not a perfect filter. A 100% efficient filter would have such high resistance to air flow that the vacuum cleaner would not work. The vacuum's filter bag holds the larger particles and allows the smaller ones to pass into the room air. Using a vacuum cleaner that discharges upward can result in a 35 % increase in airborne dust. As a result, the floor is cleaner, but the air is dirtier.

Wet-cleaning hard-surfaced flooring is less likely to cause particles to become airborne than in vacuuming or sweeping. However, good cleaning technique can help reduce the amount of fine particles discharged from the vacuum cleaner.

Begin at an edge of the carpet (in a doorway) with the wand of a canister vacuum. Always work toward uncleaned carpet with the canister behind on cleaned carpet.

Some vacuum cleaners are designed with blowers which handle high-efficienty (HEPA) filters. The filters capture at least 99.97% of the smallest particles in the discharge air. Because these vacuums are expensive, they may be justified only if someone in the household has severe allergies.

Less-expensive alternatives are the special replacement bags now available. Which claim to improve the collection efficiency of older vacuum cleaners. Keep in mind, however, that improved filtration efficiency comes at the expense of air flow, and good vacuum cleaning requires both vacuum and air flow.

A central vacuum system with motor, suction blower, and filter bag installed in the basement or garage may solve several problems of portable cleaners. There is no air discharge into a home's living space; the vacuum discharge air and small particles are exhausted to the outside. Being isolated from the living area, the motor and blower noise is less evident in the room being vacuumed.

Upholstered furniture is another dust source. It should be vacuumed twice a month and professionally cleaned at least once a year. Leather upholstery is an alternative that reduces the dust source.

Dust Mites and Animal Dander

Dust mites are microscopic animals that use dead human skin cells as a food source. Various allergens are produced by dust mite feces and body parts. They cause sensitive individuals to experience sneezing; nasal obstruction and discharge; redness, watering and itching of the eyes; wheezing and difficulty in breathing; and skin rash and itching.

For dust mites to reach concentrations high enough to cause problems, certain environmental conditions must exist; a food source of skin cells, relative humidity greater than 45 percent and a uniform temperature of 65 to 80 degrees Fahrenheit.

Highest concentrations of the mites are found in carpets, fabric-covered partitions or walls, and bedding and mattresses. Persons experiencing chronic symptoms should be tested by an allergist.

Pet dander is another allergen. Some individuals can experience allergic symptoms when the dander becomes airborne. Others are sensitive to the saliva of pets.

If a household member is allergic to animal dander, the solution that offers the most relief is to remove the animal from the house. Vacuuming furnishings captures some dander but it does not offer complete relief. Keeping the pet and pet areas clean can help to reduce animal dander. Launder pets bedding weekly, clean pet areas daily, and control moisture by wiping up any spilled water. Bathe and brush pet weekly. At a minimum, keep the pet out of the bedroom or sleeping area.

Several measures are effective in reducing the concentration of dust mites, as well as reducing allergic symptoms in individuals sensitive to dust mites.

* Vacuum-cleaning intensively and regularly floors, carpets, fabric covered furniture, mattresses and bed frames. Use a cleaner with a high-efficiency filter (HEPA), if possible.
*Lowering the relative humidity of the room air to below 45 percent and the temperature to below 68 degrees. The humidity should be reduced even more if the temperature is increased.
*Ventilating with outside air if the infiltration rates (air leakage) naturally are low.
*Using fitted sheets or allergen-tight covers over mattresses.
* Replacing feather and down pillows with those that have synthetic fillings
* Steam cleaning the carpet and fabric-covered furniture
* Removing fabric furnishing, such as replacing the carpet with hard-surface flooring
* Washing bedding in hot water (130 degrees or hotter)weekly.

Lead Dust

Paint used on both interior and exterior walls of homes before 1978 may contain lead compounds. Dried paint solids can contain up to 40 percent lead. Paint solids end up on the floor from peeling, chipping, oxidation or abrasion when doors and windows are opened and closed.

Another source of lead is soil that has been permanently contaminated. The lead comes from the exhaust fumes of vehicles that use leaded gasoline or exterior lead-based paint. Children are at risk when they play on contaminated soil and from contaminated soil tracked into the house.

Vacuum cleaning floors and carpets to remove lead particles is ineffective. It can actually increase the amount of lead dust in the air.

Intensive cleaning with a central vacuum system or a high-efficiency filter will gradually reduce the lead concentration in the carpet. However, many repetitions are needed to reduce the concentration.

Two-stage steam cleaning- using special

detergents and combining vacuum cleaning with shampooing - also is not very effective. A large amount of lead remains in the carpet. In severe cases, the only solution is to remove and dispose of the carpet.

Repeatedly wet cleaning hard-surface floors and other hard surfaces, such as window sills, is an effective method of removing lead dust. Use a wet sponge or mop with a detergent or trisodiumphosphate (TSP) to clean up lead dust. TSP can be purchased from local hardware stores.

Wipe soil off shoes on shoe-cleaning pads at entrances. When lead is known to be in the soil outside the house, shoes should be removed as residents enter the house.

Air Ducts

Air ducts can be a source of dirt, dust or biological contaminants and create an indoor air problem, but this is rare. Duct cleaning may release contaminants into the home and become the source of a problem.

Air distribution ducts in a new home collect construction dust during and after installation. With the initial flow of air, construction dust is blown into the rooms through the air supply ducts, and dust in the return air ducts is caught in the furnace filters. After a few days or weeks, only a thin coating of dust remains on the duct surfaces because the dust is caught in the filters. Filters must be inspected regularly and cleaned or replaced, according to the manufacturers' directions.

Several factors can cause dust to cling to duct surfaces. Oily or greasy aerosol produced by cooking and other household activities can attach to the ducts as it passes through. The moisture from bathing or showering, cooking or improperly vented dryers also acts as an adhesive on duct walls. When winter humidity levels are low, air passing over a sheet metal air duct creates a static-electric charge on the metal surface. The static charge attracts fine particles and the oil or moisture coating holds them.

Duct cleaning is not considered a routine procedure for maintaining a heating and cooling system. Duct cleaning or replacement is justified when there is water damage that causes mold to grow in the ductwork; debris blocks the air flow; dust is seen coming from supply registers; or offensive odors are coming from the ducts. Surface stains near the supply registers, especially from cigarette smoke, may indicate a need for changing the filter more often.

Duct cleaning professionals employ one or more of these methods; contaminant removal (brushing or vibration plus vacuum cleaning); encapsulation (spraying a sealer into the duct); disinfection (using a fungicide to inhibit the growth of mold); Depending on the type duct work you have, duct replacement may be the best solution.

Household Cleaning Products

By practicing preventative maintenance, one can reduce the need for using some of the potentially hazardous household chemicals.

*Clean spills and stains immediately.
* Remove food waste promptly.
*Control moisture/humidity *(30% - 50%)*
- prevent standing water - air conditioner drains or refrigerator drip pans
- fix leaks, drips and seepage problems
- use exhaust fans with high moisture activities
*Use entry way mats at all entrances

Use of some cleaning products will likely be necessary. Follow the directions on the label and use only the amount of product recommended.

Indoor air quality can be impacted by some chemicals used to clean, protect, and maintain the home and its furnishings. Use the least amount of product to get the job done. Read labels, follow safety precautions and contact the manufacturer if you have questions. Clean for health first, appearance second.

Limit use of aerosol products where possible ... aerosol products tend to release more chemicals into the air because they disperse the product into very tiny airborne droplets. As an alternative, some products are available in a pump spray which makes it easier to direct the product to its intended use, and thus releases fewer chemicals into the air.

NEVER MIX HOUSEHOLD PRODUCTS OR CHEMICALS TOGETHER.

Additional toxic chemicals may be released into the air through a chemical reaction. A common example is ammonia and chlorine bleach. When mixed they will react to form a toxic gas.

Some cleaning chemicals used in the home contain VOCs - volatile organic compounds. VOCs are organic solvents that are easily evaporated into the air, can be toxic and harmful to the environment, and can be dangerous to use if used improperly. Products that are based on organic solvents tend to be more hazardous to indoor air than water-based products.

Pesticides used around the home can be dangerous. Since they are used to kill or repel, strict adherence to safety practices and instructions is critical. Examples of pesticides are:

* herbicides - weed killers
* insecticides - to kill ants or cockroaches
* fungicides - to kill mold
* rodenticides - to kill mice
*disinfectants - to kill bacteria

Use only as directed by the product manufacturer. Never use a pesticide in the house unless it is labeled as safe for indoor use. Give careful attention to the length of time you should be out of a room after using a pesticide. Ventilate a space after pesticide use. Avoid using pesticides in the yard or around the house on a windy day as the pesticide may drift into the house.

Some products for household use are labeled as "natural" or "environmentally safe", and are often considered alternatives to "harsh chemicals". Some products are considered "generic", such as chlorine bleach, ammonia, and boric acid. These alternative products may seem safer and thus, some people may ignore directions for safe use. The word of caution is

"Any product that evaportates into the air has the potential to be an indoor air pollutant!"

When selecting "natural" or alternative" products for the home, consider:
* is the alternative product as effective, easy to use and convenient?
* are there directions for use and is safety information available?
* will the product be safe to use for the intended purpose?
* is the product in safe packaging?

Substitutes may or may not be as effective as commercially formulated products. When compared with commercial products, some substitutes require more hot water either to remove soil or to rinse effectively.

Sometimes alternatives work by added mechanical energy (rubbing) or abrasiveness instead of chemical action. You must decide if you are willing to work harder and if the surface can handle the extra abrasion.

Summary

This fact sheet has discussed how to identify potential indoor air pollutants, how to either remove or reduce the source of the pollution, and how to remove the pollutant through cleaning techniques. By implementing the strategies suggested, one should be able to manage the indoor air for a healthier living environment.

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