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# IMPROVING INDOOR AIR QUALITY

There are three basic strategies to improve indoor air quality:

- source control
- improved ventilation
- air cleaners

*For most indoor air quality problems in the home, source control is the most effective solution.*

## *Source Control*

Usually the most effective way to improve indoor air quality is to eliminate individual sources of pollution or to reduce their emissions. Some sources, like those that contain asbestos, can be sealed or enclosed; others, like gas stoves, can be adjusted to decrease the amount of emissions. In many cases, source control is also a more cost-efficient approach to protecting indoor air quality than increasing ventilation because increasing ventilation can increase energy costs.

## *Ventilation Improvements*

Another approach to lowering the concentrations of indoor air pollutants in your home is to increase the amount of outdoor air coming indoors. Most home heating and cooling systems, including forced air heating systems, do not mechanically bring fresh air into the house. Opening windows and doors, operating window or attic fans, when the weather permits, or running a window air conditioner with the vent control open increases the outdoor ventilation rate. Local bathroom or kitchen fans that exhaust outdoors remove contaminants directly from the room where the fan is located and also increase the outdoor air ventilation rate.

## *Air Cleaners*

There are many types and sizes of air cleaners on the market, ranging from relatively inexpensive tabletop models to sophisticated and expensive whole-house systems. Some air cleaners are highly effective at particle removal, while others, including most tabletop models, are much less so. Air cleaners are generally not designed to remove gaseous pollutants.

The effectiveness of an air cleaner depends on how well it collects pollutants from indoor air (expressed as a percentage efficiency rate) and how much air it draws through the cleaning or filtering element (expressed in cubic feet per minute). A very efficient collector with a low air-circulation rate will not be effective, nor will a cleaner with a high air-circulation rate but a less efficient collector. The long-term performance of any air cleaner depends on maintaining it according to the manufacturer's directions.

Another important factor in determining the effectiveness of an air cleaner is the strength of the pollutant source. Tabletop air cleaners, in particular, may not remove satisfactory amounts of pollutants from strong nearby sources. People with a sensitivity to particular sources may find that air cleaners are helpful only in conjunction with concerted efforts to remove the source.

# ***EPA'S POSITION ON RADON***

There is no scientific doubt that Radon gas is a known human lung carcinogen. Prolonged exposure to high levels of Radon gas can cause lung cancer. Millions of homes and buildings contain high levels of radon gas. EPA's efforts are directed at locating the homes with high levels and encouraging remediation of them.

As a means of prevention, EPA and the Office of the Surgeon General recommend that all homes below the third floor be tested for Radon. Because Radon is invisible and odorless, a simple test is the only way to determine if a home has high radon levels. EPA recommends mitigating homes with high Radon levels and there are straightforward reduction techniques that will work in virtually any home.

Most homes won't have a Radon problem, but there is a simple test to find out if you do or don't have high Radon levels in your home.

**Sources of Radon:** Earth and rock beneath home; well water; building materials.

**Health Effects From Exposure to Radon:** No immediate symptoms. Estimated to contribute to between 7,000 and 30,000 lung cancer deaths each year. Smokers are at higher risk of developing Radon-induced lung cancer.

**Radon Levels in Homes:** The average indoor radon level is 1.3 Pico curies per liter (pCi/L) in the United States. The average outdoor level is about 0.4 pCi/L.

**Radon in Water:** You can find publications and documents developed by EPA's Office of Ground Water and Drinking Water relating to radon in drinking water and the radon in drinking water rule at <http://www.epa.gov/safewater/radon.html>.

**Steps to Reduce Exposure to Radon:**

- Test your home for Radon - its easy and inexpensive
- Fix your home if your Radon level is 4 Pico curies per liter (pCi/L) or higher
- Radon levels of less than 4 pCi/L still pose a risk, and in many cases, may be reduced

# ASBESTOS IN YOUR HOME

Even if asbestos is in your home, this is usually NOT a serious problem. The mere presence of asbestos in a home or a building is not hazardous. The danger is that asbestos materials may become damaged over time. Damaged asbestos may release asbestos fibers and become a health hazard.

***THE BEST THING TO DO WITH ASBESTOS MATERIAL IN GOOD CONDITION IS TO LEAVE IT ALONE!*** Disturbing it may create a health hazard where none existed before.

## **Where Asbestos Hazards May Be Found In The Home**

1. Some roofing and siding shingles are made of asbestos cement.
2. Houses built between 1930 and 1950 may have asbestos as insulation.
3. Asbestos may be present in textured paint and in patching compounds used on wall and ceiling joints. Their use was banned in 1977.
4. Artificial ashes and embers sold for use in gas-fired fireplaces may contain asbestos.
5. Older products such as stovetop pads may have some asbestos compounds.
6. Walls and floors around wood burning stoves may be protected with asbestos paper, millboard, or cement sheets.
7. Asbestos is found in some vinyl floor tiles and the backing on vinyl sheet flooring and adhesives.
8. Hot water and steam pipes in older houses may be coated with an asbestos material or covered with an asbestos blanket or tape.
9. Oil and coal furnaces and door gaskets may have asbestos insulation.

## **What Is Asbestos?**

Asbestos is a mineral fiber. It can be positively identified only with a special type of microscope. There are several types of asbestos fibers. In the past, asbestos was added to a variety of products to strengthen them and to provide heat insulation and fire resistance.

## **How Can Asbestos Affect My Health?**

From studies of people who were exposed to asbestos in factories and shipyards, we know that breathing high levels of asbestos fibers can lead to an increased risk of:

- Lung cancer:
  - mesothelioma, a cancer of the lining of the chest and the abdominal cavity; and
  - asbestosis, in which the lungs become scarred with fibrous tissue.

The risk of lung cancer and mesothelioma increases with the number of fibers inhaled. The risk of lung cancer from inhaling asbestos fibers is also greater if you smoke. People who get asbestosis have usually been exposed to high levels of asbestos for a long time. The symptoms of these diseases do not usually appear until about 20 to 30 years after the first exposure to asbestos.

Most people exposed to small amounts of asbestos, as we all are in our daily lives, do not develop these health problems. However, if disturbed, asbestos material may release asbestos fibers, which can be inhaled into the lungs. The fibers can remain there for a long time, increasing the risk of disease. Asbestos material that would crumble easily if handled, or that has been sawed, scraped, or sanded into a powder, is more likely to create a health hazard.

## **Where Can I Find Asbestos And When Can It Be A Problem?**

- Most products made today do not contain asbestos. Those few products made which still contain asbestos that could be inhaled are required to be labeled as such. However, until the 1970s, many types of building products and insulation materials used in homes contained asbestos.

## **What Should Be Done About Asbestos In The Home?**

If you think asbestos may be in your home, don't panic! Usually the best thing is to LEAVE asbestos material that is in good condition ALONE. Generally, material in good condition will not release asbestos fibers. THERE IS NO DANGER unless fibers are released and inhaled into the lungs.

Check material regularly if you suspect it may contain asbestos. Don't touch it, but look for signs of wear or damage such as tears, abrasions, or water damage. Sometimes, the best way to deal with slightly damaged material is to limit access to the area and not touch or disturb it. Discard damaged or worn asbestos gloves, stovetop pads, or ironing board covers. Check with local health, environmental, or other appropriate officials to find out proper handling and disposal procedures.

If asbestos material is more than slightly damaged, or if you are going to make changes in your home that might disturb it, repair or removal by a professional is needed. Before you have your house remodeled, find out whether asbestos materials are present.

### **How To Manage An Asbestos Problem**

If the asbestos material is in good shape and will not be disturbed, do nothing! If it is a problem, there are two types of corrections: repair and removal.

REPAIR usually involves either sealing or covering asbestos material. Sealing (encapsulation) involves treating the material with a sealant that either binds the asbestos fibers together or coats the material so fibers are not released. Pipe, furnace, and boiler insulation can sometimes be repaired this way. This should be done only by a professional trained to handle asbestos safely.

Covering (enclosure) involves placing something over or around the material that contains asbestos to prevent release of fibers. Exposed insulated piping may be covered with a protective wrap or jacket.

With any type of repair, the asbestos remains in place. Repair is usually cheaper than removal, but it may make later removal of asbestos, if necessary, more difficult and costly. Repairs can either be major or minor.

### **Asbestos Do's And Don'ts For The Homeowner**

- Do keep activities to a minimum in any areas having damaged material that may contain asbestos.
- Do take every precaution to avoid damaging asbestos material.
- Do have removal and major repair done by people trained and qualified in handling asbestos. It is highly recommended that sampling and minor repair also be done by asbestos professionals.
- Don't dust, sweep, or vacuum debris that may contain asbestos.
- Don't saw, sand, scrape, or drill holes in asbestos materials.
- Don't use abrasive pads or brushes on power strippers to strip wax from asbestos flooring. Never use a power stripper on a dry floor.
- Don't sand or try to level asbestos flooring or its backing. When asbestos flooring needs replacing, install new floor covering over it, if possible.
- Don't track material that could contain asbestos through the house. If you cannot avoid walking through the area, have it cleaned with a wet mop. If the material is from a damaged area, or if a large area must be cleaned, call an asbestos professional.

All repairs should be done only by a professional trained in methods for safely handling asbestos.

# BIOLOGICAL CONTAMINANTS

Biological contaminants include bacteria, molds, mildew, viruses, animal dander and cat saliva, house dust mites, cockroaches, and pollen. There are many sources of these pollutants. Pollens originate from plants; viruses are transmitted by people and animals; bacteria are carried by people, animals, and soil and plant debris; and household pets are sources of saliva and animal dander. The protein in urine from rats and mice is a potent allergen. When it dries, it can become airborne. Contaminated central air handling systems can become breeding grounds for mold, mildew, and other sources of biological contaminants and can then distribute these contaminants through the home.

By controlling the relative humidity level in a home, the growth of some sources of biologicals can be minimized. A relative humidity of 30-50 percent is generally recommended for homes. Standing water, water-damaged materials, or wet surfaces also serve as a breeding ground for molds, mildews, bacteria, and insects. House dust mites, the source of one of the most powerful biological allergens, grow in damp, warm environments.

## Health Effects From Biological Contaminants

Some biological contaminants trigger allergic reactions, including hypersensitivity pneumonitis, allergic rhinitis, and some types of asthma. Infectious illnesses, such as influenza, measles, and chicken pox are transmitted through the air. Molds and mildews release disease-causing toxins. Symptoms of health problems caused by biological pollutants include sneezing, watery eyes, coughing, shortness of breath, dizziness, lethargy, fever, and digestive problems.

Allergic reactions occur only after repeated exposure to a specific biological allergen. However, that reaction may occur immediately upon re-exposure or after multiple exposures over time. As a result, people who have noticed only mild allergic reactions, or no reactions at all, may suddenly find themselves very sensitive to particular allergens.

Some diseases, like humidifier fever, are associated with exposure to toxins from microorganisms that can grow in large building ventilation systems. However, these diseases can also be traced to microorganisms that grow in home heating and cooling systems and humidifiers. Children, elderly people, and people with breathing problems, allergies, and lung diseases are particularly susceptible to disease-causing biological agents in the indoor air.

## Reducing Exposure to Biological Contaminants

***Install and use exhaust fans that are vented to the outdoors in kitchens and bathrooms and vent clothes dryers outdoors.***

These actions can eliminate much of the moisture that builds up from everyday activities. There are exhaust fans on the market that produce little noise, an important consideration for some people. Another benefit to using kitchen and bathroom exhaust fans is that they can reduce levels of organic pollutants that vaporize from hot water used in showers and dishwashers.

***Ventilate the attic and crawl spaces to prevent moisture build-up.***

Keeping humidity levels in these areas below 50 percent can prevent water condensation on building materials.

***If using cool mist or ultrasonic humidifiers, clean appliances according to manufacturer's instructions and refill with fresh water daily.***

Because these humidifiers can become breeding grounds for biological contaminants, they have the potential for causing diseases such as hypersensitivity pneumonitis and humidifier fever. Evaporation trays in air conditioners, dehumidifiers, and refrigerators should also be cleaned frequently.

***Thoroughly clean and dry water-damaged carpets and building materials (within 24 hours if possible) or consider removal and replacement.***

Water-damaged carpets and building materials can harbor mold and bacteria. It is very difficult to completely rid such materials of biological contaminants.

***Keep the house clean. House dust mites, pollens, animal dander, and other allergy-causing agents can be reduced, although not eliminated, through regular cleaning.***

People who are allergic to these pollutants should use allergen-proof mattress encasements, wash bedding in hot (130° F) water, and avoid room furnishings that accumulate dust, especially if they cannot be washed in hot water. Allergic individuals should also leave the house while it is being vacuumed because vacuuming can actually increase airborne levels of mite allergens and other biological contaminants. Using central vacuum systems that are vented to the outdoors or vacuums with high efficiency filters may also be of help.

***Take steps to minimize biological pollutants in basements.***

Clean and disinfect the basement floor drain regularly. Do not finish a basement below ground level unless all water leaks are patched and outdoor ventilation and adequate heat to prevent condensation are provided. Operate a dehumidifier in the basement if needed to keep relative humidity levels between 30 - 50 percent.

# CARBON MONOXIDE

**Sources:** Unvented kerosene and gas space heaters; leaking chimneys and furnaces; back drafting from furnaces, gas water heaters, wood stoves, and fireplaces; gas stoves. Automobile exhaust from attached garages. Environmental tobacco smoke.

**Health Effects:** At low concentrations, fatigue in healthy people and chest pain in people with heart disease. At higher concentrations, impaired vision and coordination; headaches; dizziness; confusion; nausea. Can cause flu-like symptoms that clear up after leaving home. Fatal at very high concentrations.

**Levels in Homes:** Average levels in homes without gas stoves vary from 0.5 to 5 parts per million (ppm). Levels near properly adjusted gas stoves are often 5 to 15 ppm and those near poorly adjusted stoves may be 30 ppm or higher.

## **Steps to Reduce Exposure:**

- Keep gas appliances properly adjusted.
- Consider purchasing a vented space heater when replacing an unvented one.
- Use proper fuel in kerosene space heaters.
- Install and use an exhaust fan vented to outdoors over gas stoves.
- Open flues when fireplaces are in use.
- Choose properly sized wood stoves that are certified to meet EPA emission standards. Make certain that doors on all wood stoves fit tightly.
- Have a trained professional inspect, clean, and tune-up central heating system (furnaces, flues, and chimneys) annually. Repair any leaks promptly.
- Do not idle the car inside garage.

# LEAD

Lead has long been recognized as a harmful environmental pollutant. In late 1991, the Secretary of the Department of Health and Human Services called lead the "number one environmental threat to the health of children in the United States." There are many ways in which humans are exposed to lead: through air, drinking water, food, contaminated soil, deteriorating paint, and dust. Airborne lead enters the body when an individual breathes or swallows lead particles or dust once it has settled. Before it was known how harmful lead could be, it was used in paint, gasoline, water pipes, and many other products.

Old lead-based paint is the most significant source of lead exposure in the U.S. today. Harmful exposures to lead can be created when lead-based paint is improperly removed from surfaces by dry scraping, sanding, or open-flame burning. High concentrations of airborne lead particles in homes can also result from lead dust from outdoor sources, including contaminated soil tracked inside, and use of lead in certain indoor activities such as soldering and stained-glass making.

## Health Effects of Exposure to Lead

Lead affects practically all systems within the body. At high levels (lead levels at or above 80 micrograms per deciliter (80  $\mu\text{g}/\text{dl}$ ) of blood), it can cause convulsions, coma, and even death. Lower levels of lead can adversely affect the brain, central nervous system, blood cells, and kidneys.

The effects of lead exposure on fetuses and young children can be severe. They include delays in physical and mental development, lower IQ levels, shortened attention spans, and increased behavioral problems. Fetuses, infants, and children are more vulnerable to lead exposure than adults since lead is more easily absorbed into growing bodies, and the tissues of small children are more sensitive to the damaging effects of lead. Children may have higher exposures since they are more likely to get lead dust on their hands and then put their fingers or other lead-contaminated objects into their mouths.

Get your child tested for lead exposure. To find out where to do this, call your doctor or local health clinic.

## Ways to Reduce Exposure to Lead

***Keep areas where children play as dust-free and clean as possible.***

Mop floors and wipe window ledges and chewable surfaces such as cribs with a solution of powdered automatic dishwasher detergent in warm water. (Dishwasher detergents are recommended because of their high content of phosphate.) Most multi-purpose cleaners will not remove lead in ordinary dust. Wash toys and stuffed animals regularly. Make sure that children wash their hands before meals, naptime, and bedtime.

***Reduce the risk from lead-based paint.***

Most homes built before 1960 contain heavily leaded paint. Some homes built as recently as 1978 may also contain lead paint. This paint could be on window frames, walls, the outside of homes, or other surfaces. Do not burn painted wood since it may contain lead.

***Leave lead-based paint undisturbed if it is in good condition; do not sand or burn off paint that may contain lead.***

Lead paint in good condition is usually not a problem except in places where painted surfaces rub against each other and create dust (for example, opening a window).

***Do not remove lead paint yourself.***

Individuals have been poisoned by scraping or sanding lead paint because these activities generate large amounts of lead dust. Consult your state health or housing department for suggestions on which private laboratories or public agencies may be able to help test your home for lead in paint. Home test kits cannot detect small amounts of lead under some conditions. Hire a person with special training for correcting lead paint problems to remove lead-based paint. Occupants, especially children and pregnant women, should leave the building until all work is finished and clean up is done.

***Do not bring lead dust into the home.***

If you work in construction, demolition, painting, with batteries, in a radiator repair shop or lead factory, or your hobby involves lead, you may unknowingly bring lead into your home on your hands or clothes. You may also be tracking in lead from soil around your home. Soil very close to homes may be contaminated from lead paint on the outside of the building. Soil by roads and highways may be contaminated from years of exhaust fumes from cars and trucks that used leaded gas. Use doormats to wipe your feet before entering the home. If you work with lead in your job or a hobby, change your clothes before you go home and wash these clothes separately. Encourage your children to play in sand and grassy areas instead of dirt that sticks to fingers and toys. Try to keep your children from eating dirt, and make sure they wash their hands when they come inside.

***Find out about lead in drinking water.***

Most well and city water does not usually contain lead. Water usually picks up lead inside the home from household plumbing that is made with lead materials. The only way to know if there is lead in drinking water is to have it tested. Contact the local health department or the water supplier to find out how to get the water tested.

***Eat right.***

A child who gets enough iron and calcium will absorb less lead. Foods rich in iron include eggs, red meats, and beans. Dairy products are high in calcium. Do not store food or liquid in lead crystal glassware or imported or old pottery. If you reuse old plastic bags to store or carry food, keep the printing on the outside of the bag.

# ASTHMA TRIGGERS

Below are five common asthma triggers found in homes and what you can do to reduce you and your child's exposure to them. Not all of the asthma triggers listed here affect every person with asthma. Not all asthma triggers are listed here. See your doctor or health care provider for more information.

<i><b>ASTHMA TRIGGERS</b></i>	<i><b>POSSIBLE SOLUTIONS</b></i>
<p><i><b>Secondhand Smoke</b></i></p> <p>Asthma can be triggered by the smoke from the burning end of a cigarette, pipe, or cigar and the smoke breathed out by a smoker.</p>	<p>Choose not to smoke in your home or car and do not allow others to do so either.</p>
<p><i><b>Dust Mites</b></i></p> <p>Dust mites are too small to be seen but are found in every home. Dust mites live in mattresses, pillows, carpets, fabric-covered furniture, bedcovers, clothes, and stuffed toys.</p>	<p>Wash sheets and blankets once a week in hot water.</p> <p>Choose washable stuffed toys, wash them often in hot water, and dry thoroughly. Keep stuffed toys off beds.</p> <p>Cover mattresses and pillows in dust-proof (allergen-impermeable) zippered covers.</p>
<p><i><b>Pets</b></i></p> <p>Your pet's skin flakes, urine, and saliva can be asthma triggers.</p>	<p>Consider keeping pets outdoors or even finding a new home for your pets, if necessary.</p> <p>Keep pets out of the bedroom and other sleeping areas at all times, and keep the door closed.</p> <p>Keep pets away from fabric-covered furniture, carpets, and stuffed toys.</p>
<p><i><b>Molds</b></i></p> <p>Molds grow on damp materials. The key to mold control is moisture control. If mold is a problem in your home, clean up the mold <u>and</u> get rid of excess water or moisture. Lowering the moisture also helps reduce other triggers, such as dust mites and cockroaches.</p>	<p>Wash mold off hard surfaces and dry completely. Absorbent materials, such as ceiling tiles and carpet, with mold may need to be replaced.</p> <p>Fix leaky plumbing or other sources of water. Keep drip pans in your air conditioner, refrigerator, and dehumidifier clean and dry.</p> <p>Use exhaust fans or open windows in kitchens and bathrooms when showering, cooking, or using the dishwasher.</p> <p>Vent clothes dryers to the outside.</p> <p>Maintain low indoor humidity, ideally between 30-50% relative humidity. Humidity levels can be measured by hygrometers that are</p>

	available at local hardware stores.
<b><i>Pests</i></b>  Droppings or body parts of pests such as cockroaches or rodents can be asthma triggers.	<p>Do not leave food or garbage out. Store food in airtight containers. Clean all food crumbs or spilled liquids right away.</p> <p>Try using poison baits, boric acid (for cockroaches), or traps first before using pesticidal sprays. If sprays are used, limit the spray to infested area, carefully follow instructions on the label, and make sure there is plenty of fresh air when you spray, and keep the person with asthma out of the room.</p>
<b><i>Also...</i></b>	<p>House dust may contain asthma triggers. Remove dust often with a damp cloth, and vacuum carpet and fabric-covered furniture to reduce dust build-up. Allergic people should leave the area being vacuumed. Using vacuums with high efficiency filters or central vacuums may be helpful.</p> <p>When your local weather forecast announces an ozone action day, stay indoors as much as possible.</p>