



HOUSING

Healthy Homes: Improving Indoor Air Quality

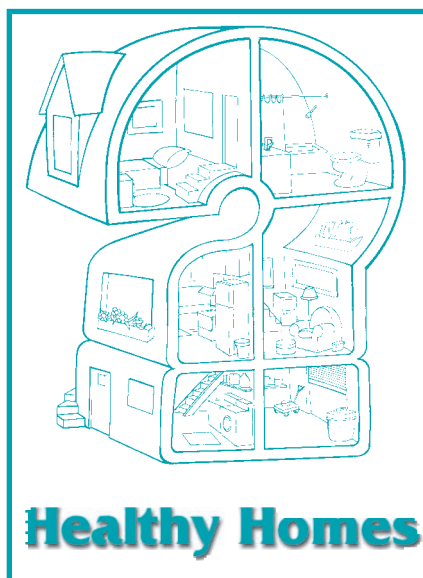
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Have you ever stopped to think about the air quality inside your home? Many people associate air pollution with large, industrial cities and know that this air is often a health hazard. However, they are less likely to realize that the air inside one's home is often more hazardous than polluted outdoor air. Due to technology, changes in work patterns and a variety of other factors, most people spend at least 90 percent of their time indoors. Young children, the elderly and people with health problems — those who are most susceptible to the effects of poor indoor air — are likely to spend even more time inside. Therefore, it is crucial that you are aware of the condition of the air inside your home and how to improve it when needed.

Is the air inside your home putting you and your family at risk for



health problems? The following are some indications that indoor air may need some improvement:

- ✓ stale, stuffy air with a distinctive odor;
- ✓ lingering cooking odors;
- ✓ excessive humidity;
- ✓ dirty heating and air conditioning units;
- ✓ health reactions after remodeling, installing new furniture or carpeting, or using household products.

If you notice one or more of these conditions, you can probably improve the air quality in your home. This guide helps you to improve your home's air quality by highlighting several substances that commonly pollute indoor

air, including:

- biological contaminants;
- carbon monoxide and other combustion byproducts;
- lead;
- secondhand smoke;
- formaldehyde and volatile organic compounds;
- asbestos;
- radon.

This guide lists some potential problems specific to each room of the house and suggests methods for improving indoor air quality. There is also a section highlighting the relationship between asthma and indoor air quality.

Summary of common pollutants

Biological contaminants

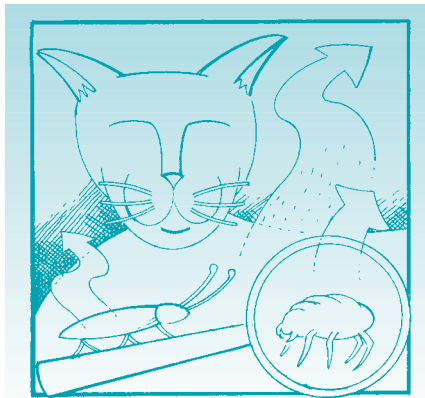
Biological contaminants include a wide variety of living or once-living organisms that can pollute the air. Some common types include:

- molds, mildew and other fungi;
- animal hair, dander, and saliva;
- microscopic organisms, such as dust mites, bacteria and viruses;
- insects and their parts;
- pollen.

Some of these pollutants, like mold, have the potential to damage the interi-

or surfaces of a home. These pollutants are a common cause of illness. The air quality of every home suffers to some degree from biological contamination. However, even though these organisms cannot be eliminated entirely, they can be adequately controlled with proper prevention methods.

Sources of biological contamination in the home



Molds

Mold can grow in any climate and region of the country. However, the warm, humid environments in kitchens, bathrooms, laundry rooms and basements are especially optimal. As mold grows, it releases spores into the air. These spores settle and form new colonies of mold on other surfaces. Mold grows on organic surfaces, such as paper, wood, textiles, grease and soap scum. It can eventually eat away at the growing surface itself. Mold is not always readily visible because it often grows inside walls and insulation or behind furniture. However, mold may be detected by a musty odor.

Animal products

Pets are a source of several contaminants, including hair, dander (flakes of skin), dried saliva and dried urine. These particles float easily in the air and spread throughout a home. In addition, insects and their body parts can also pollute the air.

Microscopic organisms

Dust mites are tiny organisms that feed on dead human skin cells. They are found in bedding, clothing and other textiles and become airborne during activities such as vacuuming and making beds. Bacteria and viruses also fall into this category and cause infectious diseases. They are usually spread through person-to-person contact, but they can also circulate in a home's ventilation system.

Pollen

Pollen comes from plants and may enter a home through open windows or on pets. Some houseplants may contribute to pollen levels in the home.

Health effects

Biological contaminants are a very common cause of illness. Infants and children, older persons and people with respiratory problems are particularly susceptible to the effects of biological pollutants. Many people are sensitive to at least one of these organisms and experience allergic reactions to them when levels are high. Symptoms of an allergic reaction include:

- ✓ watery, itchy eyes;
- ✓ wheezing;
- ✓ runny nose and congestion;
- ✓ coughing;
- ✓ headaches;
- ✓ dizziness;
- ✓ fatigue.

Stachybotrys atra

What is *Stachybotrys atra*?

Stachybotrys is a greenish-black, slimy mold that grows on materials that contain cellulose, such as sheetrock, ceiling tiles, wood, wallpaper and cardboard. *Stachybotrys* thrives when these materials are chronically wet, due to high humidity levels, water leakage, condensation or flooding.

Why is *Stachybotrys* a problem?

Stachybotrys is a very dangerous mold because it produces airborne toxins that can cause serious health problems and even death. Anyone can be affected, but infants and people with respiratory problems are at greatest risk. Symptoms of exposure to *Stachybotrys* include chronic fatigue, memory and hearing loss, severe breathing problems, flu-like symptoms and bleeding in the lungs.

How do I know if my house has *Stachybotrys* growth?

Stachybotrys is black and slimy and grows on materials that have been wet for several days. However, there are more common molds that look very similar to *Stachybotrys*. The only way to determine with certainty that mold growth is *Stachybotrys* is to have it tested in a laboratory.

How do I get rid of *Stachybotrys*?

In all cases, the source of water accumulation must be attended to or the mold will return. If *Stachybotrys* contamination is minimal, it may be killed with a bleach-water solution that is applied to the affected surface and rinsed after 15 minutes. The person cleaning should protect his or her face and hands and make sure the area is well ventilated. Surfaces larger than one or two square feet should only be treated by a qualified professional.

These pollutants are also frequent triggers of:

- bronchitis;
- asthma (both as a source and a trigger of asthma attacks).

Bacteria and viruses may cause infectious diseases, such as tuberculosis and influenza. Some molds release toxins dangerous enough to damage body tissues and organs and can even cause death. (For information about a particularly dangerous mold, *Stachybotrys atra*, see box on page 2.)

Prevention and solutions

Moisture control

In order to prevent problems related to excessive moisture, the relative humidity of a home should be kept within the range of 30 percent to 50 percent. Although Missouri is a humid state, there are many ways to control moisture levels in the home.

- ✓ Use dehumidifiers and air conditioners to lower humidity levels, especially during summer months.
- ✓ Use exhaust fans that are vented to the outside in kitchens and bathrooms to reduce high moisture content.
- ✓ Attend to water problems promptly.
- ✓ Make sure rain water drains away from the home's foundation in order to prevent moisture problems in the basement or crawlspace.
- ✓ Refrain from using basements as living quarters unless they are dry and have sufficient ventilation.
- ✓ Make sure attics and crawl spaces are properly ventilated, as moisture often accumulates in them.
- ✓ Limit the use of humidifiers and the number of houseplants.

Cleaning

Cleaning is important because surfaces coated with grease, soap scum and other organic materials are very susceptible to mold growth. Cleaning also helps eliminate the buildup of ani-

mal products and microscopic organisms.

- ✓ Clean appliances that come into contact with water regularly, such as dehumidifiers and window type air conditioning units.
- ✓ Use a vacuum with a high-efficiency filter. This will reduce animal dander and hair and tiny organisms, such as dust mites.
- ✓ If individuals are particularly sensitive to biological pollutants, replace carpeting with wood or vinyl flooring.
- ✓ Mold must be thoroughly removed in order to eliminate a potential air quality hazard, as some people are still sensitive to dead mold spores. Use soap and water or store products to remove mold deposits from shower walls, bathtubs and other like surfaces.
- ✓ In order to remove mold from structural surfaces, such as ceiling tiles or wallboard, use detergent solution and water and dry the area thoroughly. Moisture problems should be solved at the same time to prevent further growth. Bleach (or biocide), followed by thorough rinsing with water and rapid drying, should be used for hard-to-clean areas, such as fan coil units and areas where mold cannot be removed by detergent solutions. Using bleach on structural surfaces will kill the mold but not remove it. Only solving the moisture problem will prevent it.
- ✓ When removing mold from structural surfaces, it is recommended that individuals wear a facemask, eye protection and gloves in order to prevent harmful exposure.
- ✓ Minimize/control dust generated during mold removal process.

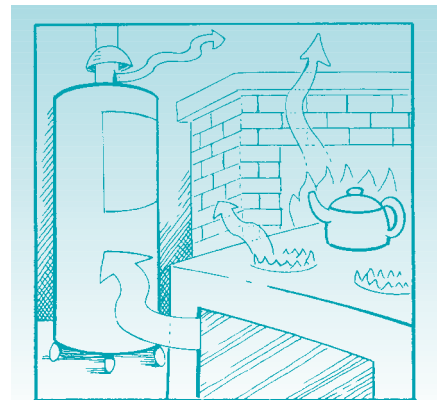
Sources for additional information

- ◆ Biological Pollutants in Your Home (EPA Factsheet)

http://www.epa.gov/iaq/pubs/bio_1.html

- ◆ Molds in the Environment (National Center for Environmental Health)
<http://www.cdc.gov/nceh/asthma/factsheets/molds/molds.htm>
- ◆ Questions and Answers about *Stachybotrys chartarum* and Other Molds (NCEH)
<http://www.cdc.gov/nceh/asthma/factsheets/molds/default.htm>
- ◆ Moisture and Mildew Publications (University of Florida)
<http://edis.ifas.ufl.edu/HE346>

Carbon monoxide and other combustion by-products



Combustion by-products are gases or pollutants that are emitted from burning fuels. These by-products include carbon monoxide, secondhand smoke, nitrogen dioxide and sulfur dioxide. Carbon monoxide, a colorless and odorless gas, is the most deadly of these by-products. It prevents the blood from delivering oxygen to the rest of the body and, at high levels, can kill a person in minutes. In 1998, 7,700 people were treated in hospital emergency rooms for carbon monoxide poisoning due to leakage from home heating systems. However, the Missouri Department of Health states that carbon monoxide poisoning is extremely underreported and more poisonings usually occur than are documented.

Sources of carbon monoxide in the home

Carbon monoxide and other combustion by-products are produced when fuels such as wood, coal, charcoal, natural gas, oil and propane are burned. Carbon monoxide is also emitted from unvented space heaters, furnaces, gas stoves, fireplaces, water heaters, dryers and the auto exhaust in attached garages.

Health effects

The effects of exposure to carbon monoxide are often confused with the flu or food poisoning. At low levels, carbon monoxide exposure can result in:

- ✓ nausea;
- ✓ weakness;
- ✓ fatigue;
- ✓ impaired coordination.

High levels can cause:

- paralysis;
- brain damage;
- coma;
- death.

Hundreds of people die each year from carbon monoxide poisoning. Particularly at risk are:

- fetuses and infants;
- older persons;
- people with heart or respiratory diseases and people with anemia.

Prevention and solutions

There are many ways people can prevent combustion by-products from accumulating in their homes.

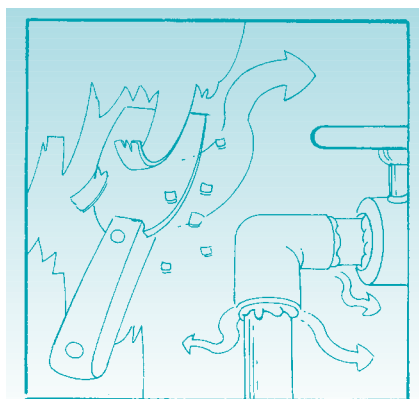
- ✓ Install appliances and combustion equipment properly and inspect them on a regular basis.
- ✓ Clean and inspect flues and chimneys on a regular basis.
- ✓ Vent gas ranges and heaters to the outdoors.
- ✓ When possible, install combustion appliances away from the main living areas of the home, such as in a utility room or basement.

- ✓ Never use ovens and gas ranges to heat the home, and never burn charcoal inside.
- ✓ Never leave cars and lawn mowers running in the garage.
- ✓ Install carbon monoxide detectors near sleeping areas, as carbon monoxide poisoning often occurs when people are asleep.
- ✓ When high levels of carbon monoxide are detected, get fresh air immediately and go to the emergency room if necessary.

Sources for additional information

- ◆ Protect Your Family and Yourself from Carbon Monoxide Poisoning (EPA Factsheet)
<http://www.epa.gov/iaq/pubs/cofsh.html>
- ◆ Wayne State University School of Medicine's Carbon Monoxide Headquarters
<http://www.phymac.med.wayne.edu/FacultyProfile/penney/CO1.htm>

Lead



Lead is a highly toxic soft metal that was once widely used in paint, gasoline, pipes and other products. The federal government banned the use of lead in paint and plumbing products in 1978, but homes built before then are likely to contain lead in one form or another. According to the U.S. Department of Housing and Urban Develop-

ment, 74 percent of houses built before 1980 contain potentially dangerous levels of lead paint. Homes built before 1950 are very likely to have high lead levels, especially paint used on windows and exterior surfaces. In Missouri, 28 percent of the housing was built before 1950. Additionally, Missouri is the largest producer of lead in the United States. Missouri Department of Health figures (1999) show that an estimated 10.9 percent of children tested, between ages birth to 6 years old, had elevated blood lead levels (greater than 9 mg/dl). The Environmental Protection Agency ranked Missouri ninth among all states on a scale of estimated lead risk, based on the age of the state's housing, the number of children in poverty and the number of young children. The risk of lead poisoning is significant for Missourians and should be given serious attention.

Sources of lead in the home

Lead-based paint

Paint in good condition is usually not a hazard. However, aging lead paint chips easily and can crumble into dust. These paint particles then contaminate the air in the home. Lead paint is especially hazardous in easy-to-reach places that receive a lot of use, such as window sills, doors and door frames, stairs and banisters, and porches. The paint is more likely to chip due to frequent contact, and young children can easily touch these places. These particles could be ingested by hand-to-mouth contamination and lead to poisoning. Old toys and furniture coated with lead paint are also sources of contamination.

Lead pipes and lead solder

Lead pipes and solder are a concern because they contaminate the water that runs through them, especially when the water is soft, corrosive or acidic. The longer water stands in

pipes, the greater opportunity there is for lead to dissolve into the water. One cannot see, smell or taste lead in water, and boiling does not rid water of lead.

Occupations and hobbies

People who work in certain occupations, such as construction, plumbing and auto repair, encounter lead products regularly. They may bring lead dust into the home via their clothes or shoes. Engaging in hobbies such as stained glass work or target shooting also exposes individuals to lead products.

Health effects

Lead is toxic at both low and high concentrations and accumulates in the body over time, causing irreversible effects. Children are especially at risk for lead poisoning because their growing bodies absorb lead more readily and they are more likely to put contaminated objects or dirty hands in their mouths. Effects of lead poisoning in children include:

- lower IQ;
- kidney damage;
- hearing loss;
- anemia;
- headaches;
- slowed growth;
- behavioral problems, such as impulsiveness, restlessness, short attention span;
- mental retardation.

In the United States, 1 out of 11 children have dangerous levels of lead in their bloodstream; however, many children with high lead levels seem normal and healthy. The Environmental Protection Agency recommends that all children ages six and younger should be tested for lead poisoning. Testing is inexpensive and readily available.

Although children are most susceptible to lead poisoning, adults also suffer negative health effects from exposure

to lead. Pregnant women and their growing fetuses are particularly at risk. Negative health consequences include:

- reproductive problems;
- high blood pressure;
- digestive problems;
- nerve disorders;
- memory and concentration problems;
- muscle and joint pain.

Treatment of lead poisoning for people of all ages depends on the severity of the problem, but it can include changes in diet, medication and/or hospitalization.

Prevention and solutions

There are many ways to prevent lead poisoning in the home.

- ✓ Inspect your home for lead-based paint. Lead paint in good condition is probably safe, but deteriorating paint is a hazard and should only be removed by a professional. Attempting to remove lead paint on one's own can actually increase the risk of contamination.
- ✓ In order to prevent water contamination, only use cold water for drinking, cooking and making baby formula. Run water until the faucet is cold to the touch before using the water.
- ✓ Damp mop and wipe off window frames and sills regularly to reduce the amount of lead dust in the air and on frequently touched surfaces.
- ✓ Wash children's hands and toys often to prevent the ingestion of harmful particles.
- ✓ Eat a diet that is low in fat and high in iron and calcium, which prevents the body from absorbing as much lead.

Sources for additional information

- ◆ National Lead Information Center Hotline
1-800-424-LEAD (1-800-424-5323)
- ◆ Lead Poisoning Prevention Program

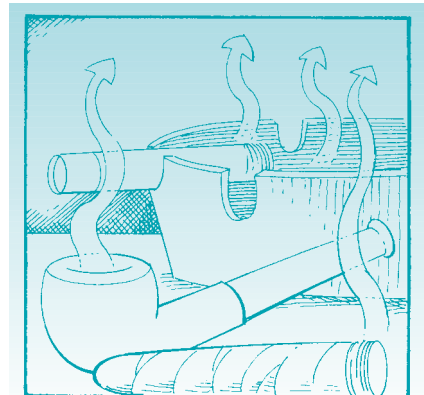
(Center for Disease Control and Prevention)

<http://www.cdc.gov/nceh/lead/factsheets/leadfacts.htm>

- ◆ HUD Office of Lead Hazard Control
<http://www.hud.gov/lea/leahome.html>
- ◆ You Do Not Have To Live With Lead Dust (Healthy Indoor Air)
http://www.montana.edu/wwwcxair/facts_lead.html

Secondhand smoke

Secondhand smoke is smoke from



another person's cigarette, pipe, or cigar. It comes from: (1) the smoker's mouth, after he or she exhales, and (2) the burning tobacco itself (also known as sidestream smoke). In the United States, more than 40 percent of children live in a home with at least one smoker. Thirty-seven percent of non-smoking adults live or work with someone who smokes. Missouri's smoking prevalence rate of 28.6 percent of adults ranks second only to Kentucky. In Missouri, 24 percent of adults and 27 percent of children are exposed to secondhand smoke in their homes.

Health effects

In 1995, smoking was responsible for 70 percent of all cancer deaths and 19 percent of cardiovascular disease deaths in Missouri. Exposure to secondhand smoke can be even more dangerous than smoking itself, because sidestream smoke contains up to 100

times more toxins than the smoke inhaled by smokers. Harmful effects of secondhand smoke include:

- development of lung cancer;
- heart disease;
- lung diseases such as emphysema, asthma, and pneumonia.

Thousands of nonsmokers die each year from lung cancer and heart disease because of exposure to secondhand smoke. Infants and children are particularly susceptible to the effects of secondhand smoke, and they are more likely to develop respiratory infections, asthma, and bronchitis when exposed to it.

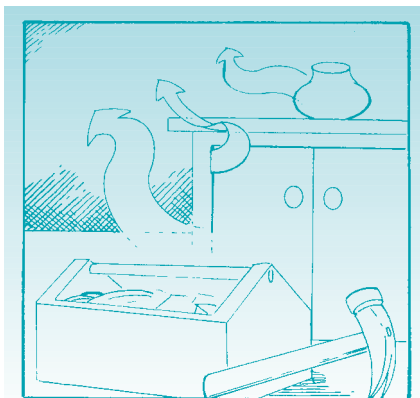
Prevention and solutions

In order to keep indoor air free from secondhand smoke, the source of the smoke must be removed. A separate indoor smoking area, proper ventilation and air cleaners can reduce the amount of smoke in the air. However, it will not eliminate the smoke entirely and the risks involved. The best way to prevent the harmful effects of secondhand smoke is to stop smoking and not allow others to smoke inside the home. If adults do smoke, they should do so outdoors.

Sources for additional information

- ◆ Secondhand Smoke Factsheet (American Lung Association)
http://www.lungusa.org/tobacco/secondhand_factsheet99.html
- ◆ Environmental Tobacco Smoke (EPA)
<http://www.epa.gov/iaq/ets.html>

Formaldehyde and volatile organic compounds



Volatile Organic Compounds (VOC's) are liquid and solid chemicals that readily evaporate into the air. Formaldehyde, a particularly harmful VOC, is a chemical released into the air as a strong-smelling gas and is found in many products.

Sources of VOC's and formaldehyde in the home

There are many household products with potentially dangerous chemicals, including:

- ✓ paint;
- ✓ cleaners;
- ✓ aerosol sprays;
- ✓ pesticides;
- ✓ deodorizers;
- ✓ mothballs.

A major source of formaldehyde gas is particleboard. The adhesive that holds the layers of wood together can break down and release formaldehyde gas. Other sources of formaldehyde include:

- ✓ plywood;
- ✓ textiles;
- ✓ laminated furniture or cabinets;
- ✓ draperies;
- ✓ glues and adhesives;
- ✓ foam insulation.

Products usually emit less formaldehyde as they age, so formaldehyde pollution is more commonly found in new homes.

Health effects

The health risks associated with VOC's depend on the type of chemical, its concentration, and the length of exposure. Exposure to low levels of VOC's does not appear to be too dangerous, but the effects of breathing in harmful fumes can accumulate over time. VOC's can also be harmful if they make contact with the eyes or skin or are ingested. Formaldehyde is a strong irritant and can cause:

- ✓ watery eyes;
- ✓ burning sensations in the nose and throat;
- ✓ coughing;
- ✓ headaches;
- ✓ nausea.

Large doses can trigger asthma attacks and even cause damage to internal organs, although some people are more sensitive to it than others.

Prevention and solutions

The best way to prevent exposure to VOC's is to avoid using them whenever possible by using non-hazardous or less hazardous alternatives.

- ✓ Try to buy products with harmful chemicals in small amounts so they can be used quickly.
- ✓ Only use VOC's outside or in well ventilated areas.
- ✓ Follow manufacturer's directions carefully, and do not mix products unless the label says it is okay to do so.
- ✓ After use, seal containers tightly and store where children cannot reach them.

In order to prevent formaldehyde buildup:

- ✓ Apply varnishes or sealants on wood products containing formaldehyde in order to trap the gas and prevent it from being released.
- ✓ After purchasing new products that emit formaldehyde, such as furniture, carpet or draperies, increase ventilation in areas of installation to

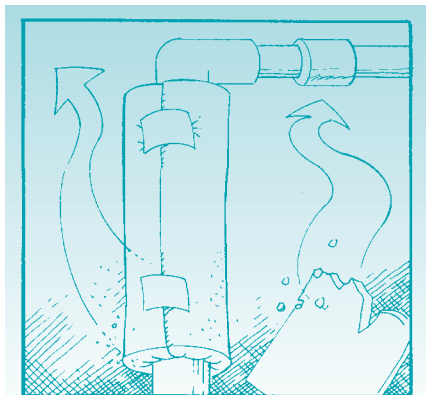
prevent a buildup of the gas.

- ✓ Choose products low in formaldehyde when possible.

Sources for additional information

- ◆ EPA Pesticides-Related Information 1-800-858-PEST (1-800-858-7378)
- ◆ An Update on Formaldehyde (EPA) <http://www.epa.gov/iaq/pubs/formald2.html>
- ◆ Household Products and Furnishings (Healthy Indoor Air) <http://www.montana.edu:80/wwwcxair/house.html>

Asbestos



Asbestos is a mineral that easily separates into small fibers. It was once widely used in many products because it is fireproof, a good thermal insulator, and can easily be manipulated into a variety of materials. However, it was banned from several substances in the 1970's when scientists learned asbestos fibers cause serious lung diseases.

Sources of asbestos in the home

Because its fibers are strong, asbestos is used to reinforce a variety of products, such as:

- ✓ floor tiles;
- ✓ walls and ceilings;
- ✓ pipe and wall insulation;
- ✓ roofing;
- ✓ siding.

Although it was banned many years ago, asbestos is still a problem in older homes. It is estimated that 20 percent of all buildings contain some asbestos material.

Health effects

As asbestos ages, it breaks down into microscopic fibers that are released into the air. These fibers remain suspended in the air for long periods of time, and people inhale them. Once inhaled, they usually remain in a person's lungs until death. Inhaling high concentrations of asbestos fibers over long periods of time can lead to lung disease. Asbestosis is a disease that scars the lungs, makes breathing difficult, and can lead to death. Breathing asbestos also increases the risk of developing lung cancer, especially in smokers. Exposure to asbestos can also contribute to other cancers, such as stomach, rectal and colon. Diseases caused by asbestos take many years to develop (about 20 to 40 years), but since the accumulation of asbestos fibers in the lungs is gradual, a person may be at risk and not know it. Currently, there is no known safe level of exposure.

Prevention and solutions

Asbestos is usually not a problem in most homes, especially if the asbestos is in good condition. If asbestos is in good condition and remains undisturbed, it will not harm people. However, deteriorating asbestos is a problem and can be treated several ways, depending on the location and extent of the problem. There are four main methods of treating deteriorating asbestos:

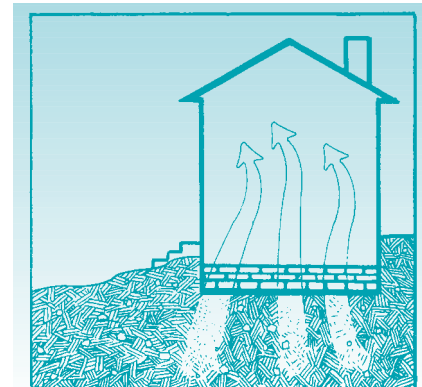
- ✓ **enclosing** the product containing asbestos with a rigid, airtight barrier;
- ✓ **coating** the materials containing asbestos with a sealant;
- ✓ **replacing** damaged materials with those that do not contain asbestos;

- ✓ **removing** products with extensive amounts of deteriorating asbestos. This process is expensive and best left to professionals.

Sources for additional information

- ◆ Asbestos Abatement/Management Ombudsman 1-800-368-5888
- ◆ EPA Asbestos-Related Information (202) 554-1404
- ◆ Asbestos in Your Home (EPA) <http://www.epa.gov/iaq/pubs/asbestos.html>

Radon



Radon is a naturally occurring radioactive gas produced by the breakdown of uranium and radium in rocks and soil. It is colorless, odorless and tasteless. As the second leading cause of lung cancer in the United States, radon is a serious air pollutant. In Missouri, testing has revealed that about 18 percent of homes have radon levels elevated above the EPA's acceptable limit of 4.0 picocuries per liter of air (4 pC/L). The EPA has designated 11 of the 114 counties in Missouri as having the potential for high radon concentrations, including counties in the north-west region of the state and those containing the St. Francois Mountains. However, high levels of radon in homes have been found in all areas of the state. Because indoor radon levels can vary widely in a small geographic area,

all homeowners should have their homes tested for radon levels.

Sources of radon in the home

Radon is found everywhere at varying levels. The most common source of indoor radon comes from the rock and soil that surrounds a house's foundation. It moves up through the soil where it originates, and moves into the air. Radon is then drawn indoors through cracks, openings around sump pumps and drains, and construction joints when the pressure in the lower levels of the house is lower than the air pressure outside. Hence, the highest concentrations of radon are found in the lowest levels of the home. Radon can also leach from rocks into the ground water. This can be a problem if a person's drinking water comes from an underground source, such as a well. Radon contamination is usually more of a problem in soil, although high concentrations of radon in drinking water can also create serious health effects.

Health effects

Radon is responsible for 10 percent of all lung cancer deaths. It is estimated that 14,000 deaths per year are related to high amounts of radon exposure. As people inhale radon gas released from the soil or water, the radioactive particles of which it is comprised become entrapped in the lungs. These particles continue to emit radiation as they break down. This radiation can damage the delicate lung tissues over time, increasing the risk for developing lung cancer. Ingesting water contaminated with radon may also put people at risk. Because radon does not cause any short term health effects and lung cancer takes many years to develop, it can go undetected for a long period of time. Smokers are especially susceptible to the development of radon-induced lung cancer.

Prevention and solutions

The Environmental Protection Agency and Surgeon General recommend that all homes be tested for radon, regardless of their geographic location. Radon levels are dependent upon many factors, and two houses next to each other may have very different radon levels.

Radon may be easily tested with a radon detector. Hardware stores sell many inexpensive, do-it-yourself test kits as well. There are two types of test kits: short-term and long-term. Short-term kits test radon levels for 2 to 7 days, while long-term kits require a testing period anywhere from one month to one year. Long-term detectors are more accurate. Homeowners can hire professionals to test the level in their homes if the home tests show levels over recommended standards. Radon levels found above the acceptable limit set by the EPA (4 pCi/L) can easily be reduced in most homes. There are several methods available, each depending upon the construction and location of the home. Contact the Missouri Department of Health to get more information.

Sources for more information

- ◆ Radon Infoline
1-800-SOS-RADON (1-800-767-7236)
- ◆ EPA's Radon Fix-It Program
1-800-644-6999
- ◆ Missouri Contact:
Kenneth V. Miller
Bureau of Radiological Health
Missouri Department of Health
1730 E. Elm
P.O. Box 570
Jefferson City, MO 65102
1-800-669-7236 (in state) or
(573) 751-6083
- ◆ Radon Specific Indoor Air Quality Publications (EPA)
<http://www.epa.gov/iaq/radon/pubs/index.html>

Asthma and indoor air quality

Asthma is a respiratory disease that makes the airways particularly susceptible to irritation and is a serious health condition. It is the seventh-ranked chronic condition in the United States and the leading chronic illness in children. Over 17 million Americans suffer from asthma, and five million of these individuals are children under the age of 18.

Although some people are born with a genetic predisposition toward developing asthma, there are many common triggers of asthma in the environment. Some of these include:

- ✓ secondhand smoke;
- ✓ outdoor air pollution;
- ✓ dust mites;
- ✓ pollen;
- ✓ animal products;
- ✓ mold;
- ✓ viral infections;
- ✓ weather changes.

Many of these triggers are indoor air pollutants that have been discussed previously in this guide. Some indicators that a person may have asthma include:

- ✓ fatigue;
- ✓ coughing;
- ✓ wheezing;
- ✓ runny nose;
- ✓ tightness in the chest;
- ✓ difficulty breathing.

During an asthma attack, a person's bronchial tubes become inflamed and produce excess mucus. Breathing becomes extremely difficult, and the amount of oxygen in the blood is reduced. About 4,000 people die each year from asthma attacks, 80 percent of whom are children.

Because asthma is often triggered by indoor air contaminants, there are several things individuals can do to prevent asthma and asthma attacks.

(continued on page 11)

Room-by-room checklist

Although indoor air quality problems may be present throughout an entire home, certain rooms are likely to be

more susceptible to specific problems than others. The following chart lists several areas of the home and their potential problems, as well as remedies for improving the air quality in each

room. As you seek to improve the air quality in your home by following the suggestions in this guide, you and your family will have cleaner air to breathe and be able to live healthier lives.

Room-by-room indoor air quality checklist

Room	Potential problems	Remedies
Kitchen	1. Unvented gas stove and range	<input type="checkbox"/> Install and use an exhaust fan while cooking. <input type="checkbox"/> Never use a gas stove to heat the home.
	2. Household cleaners	<input type="checkbox"/> Open windows and/or run the exhaust fan. <input type="checkbox"/> Use according to manufacturer's directions.
	3. Moisture from cooking and dishwashing	<input type="checkbox"/> Install and use an exhaust fan.
	4. Pressed wood cabinets	<input type="checkbox"/> After installation of cabinets, open windows and ventilate well. <input type="checkbox"/> Coat with a polyurethane finish to prevent emission of formaldehyde. <input type="checkbox"/> Maintain proper temperature and humidity levels.
Bathroom	1. Cleaning supplies	<input type="checkbox"/> Choose less-toxic products when possible. <input type="checkbox"/> Open window or run exhaust fan during use. <input type="checkbox"/> Use according to manufacturer's directions.
	2. Moisture, mold, mildew	<input type="checkbox"/> Clean sinks, showers and tubs frequently. <input type="checkbox"/> Use exhaust fans. <input type="checkbox"/> Fix plumbing leaks promptly. <input type="checkbox"/> Keep shower doors and curtains open. <input type="checkbox"/> Wipe down shower walls after use. <input type="checkbox"/> Use tile or vinyl flooring (when possible).
	3. Personal care products	<input type="checkbox"/> Open window or run exhaust fan during use.
Bedrooms	1. Humidifiers	<input type="checkbox"/> Use only when necessary. <input type="checkbox"/> Refill with clean water daily. <input type="checkbox"/> Clean frequently to prevent buildup of microbes.
	2. Moth repellents	<input type="checkbox"/> Avoid breathing vapors. Keep moth repellents in trunks or other containers and store away from living areas.
	3. Dust mites	<input type="checkbox"/> Use allergen-impermeable covers on pillows and mattresses. <input type="checkbox"/> Wash bedding in hot water at least once a week. <input type="checkbox"/> Use smooth, easy-to-clean furniture.
All rooms	1. Animal dander, hair or feathers	<input type="checkbox"/> Keep pets clean. <input type="checkbox"/> Clean house regularly.

Room-by-room checklist (continued)

Room	Potential problems	Remedies
	2. Carpets	<input type="checkbox"/> Clean and dry water-damaged carpets immediately; replace when necessary. <input type="checkbox"/> Ask retailer to air out new carpeting before installing. <input type="checkbox"/> Keep rooms well ventilated during carpet installation. <input type="checkbox"/> Vacuum regularly.
	3. Draperies	<input type="checkbox"/> Keep rooms ventilated when new draperies are installed, as they may emit formaldehyde. <input type="checkbox"/> Maintain proper humidity levels and temperature.
	4. Secondhand smoke	<input type="checkbox"/> Do not smoke in the house, and insist that others smoke outside.
	5. Dust mites	<input type="checkbox"/> Clean house and vacuum often.
	6. Lead-based paint	<input type="checkbox"/> Leave lead paint that is in good condition alone. <input type="checkbox"/> Hire a professional to replace, enclose or encapsulate deteriorating lead paint.
	7. Moisture	<input type="checkbox"/> Use exhaust fans and dehumidifiers when necessary.
Basement/ ground floor	1. Asbestos pipe wrap insulation	<input type="checkbox"/> Inspect for damage or deterioration. <input type="checkbox"/> Consult a professional to repair or remove any asbestos products.
	2. Moisture	<input type="checkbox"/> Clean and disinfect floor drain. <input type="checkbox"/> Use dehumidifiers, especially in the summer. <input type="checkbox"/> Remove mold and mildew deposits promptly.
	3. Radon	<input type="checkbox"/> Test for radon levels with an inexpensive do-it-yourself kit. <input type="checkbox"/> Consult professionals if radon levels are high.
	4. Unvented clothes dryer	<input type="checkbox"/> Vent to the outdoors.
Garage	1. Car exhaust	<input type="checkbox"/> Do not idle car in garage.
	2. Paint/hobby products	<input type="checkbox"/> Use only in well-ventilated areas or outdoors. <input type="checkbox"/> Follow manufacturer's directions. <input type="checkbox"/> Buy limited quantities. <input type="checkbox"/> Reseal containers well.
	3. Pesticides	<input type="checkbox"/> Store out of reach of children, and do not store inside the home. <input type="checkbox"/> Open windows when using indoors. <input type="checkbox"/> Follow manufacturer's directions.
	4. Stored fuels (e.g. gasoline or kerosene)	<input type="checkbox"/> Buy limited quantities. <input type="checkbox"/> Use well-sealed containers. <input type="checkbox"/> Do not store inside the home.

Room-by-room checklist (continued)

Room	Potential problems	Remedies
Heating/cooling systems	1. Air conditioner	<input type="checkbox"/> Change filter when needed. <input type="checkbox"/> Empty and clean water tray often. <input type="checkbox"/> Follow proper service and maintenance procedures.
	2. Furnace	<input type="checkbox"/> Inspect and service each year. <input type="checkbox"/> Follow proper service and maintenance procedures, including changing filters.
	3. Fireplace	<input type="checkbox"/> Open flue when fireplace is in use. <input type="checkbox"/> Inspect flue and chimney annually for blockage or other damage. <input type="checkbox"/> Always extinguish fires before going to bed for the night.
	4. Kerosene heater	<input type="checkbox"/> Vent to the outside. <input type="checkbox"/> Only use fuel recommended by the manufacturer. Refill outside. <input type="checkbox"/> If unvented, open a door to the rest of the house and open a window slightly.
	5. Wood stove	<input type="checkbox"/> Vent to the outside. <input type="checkbox"/> Choose a properly sized wood stove that meets EPA emission standards.

- ✓ Never smoke inside the home or allow anyone else to do so. When parents smoke, children are much more likely to develop asthma.
- ✓ Keep humidity levels between 30 percent and 50 percent in order to prevent mold and mildew build-up.
- ✓ Wash bedding once a week in hot water to help control the dust mite population.
- ✓ Keep pets outdoors to prevent the spread of their dander, saliva and urine. When this is not possible, keep animals out of bedrooms and away from furniture and carpeting.
- ✓ Household dust can contain many asthma triggers, so dust and vacuum frequently.
 With proper prevention, people can do much to reduce the development of asthma and asthma attacks.

Sources for additional information

- ◆ American Academy of Allergy, Asthma, and Immunology
<http://www.aaaai.org>
- ◆ Asthma Prevention Program (CDC)
<http://www.cdc.gov/nceh/asthma/factsheets/asthma.htm>
- ◆ Clear Your Home of Asthma Triggers (EPA)
<http://www.epa.gov/iaq/asthma/>
- ◆ Asthma (National Safety Council)
<http://www.nsc.org/ehc/indoor/asthma.htm>

Sources for additional information

- ◆ Environmental Protection Agency (EPA) Region 7, serves Iowa, Kansas, Missouri, and Nebraska
 1-800-223-0425
- ◆ Indoor Air Quality Information Clearinghouse
 1-800-438-4318
- ◆ Missouri Department of Health Bureau of Environmental Equity
 Jefferson City, Mo.
 1-800-699-7236 or (573) 751-6102
- ◆ American Lung Association
<http://www.lungusa.org/>
- ◆ EPA—Indoor Air Quality in Homes
<http://www.epa.gov/iaq/homes.html>
- ◆ Healthy Indoor Air
<http://www.montana.edu/wwwcxair>
- ◆ National Safety Council (NSC)—Air Quality Program
<http://www.nsc.org/ehc/airqual.htm>

- ◆ Sick Building Syndrome (EPA Factsheet)
<http://www.epa.gov/iaq/pubs/sbs.html>

References

American Lung Association. (1998). *Facts about secondhand smoke* [Brochure].

American Lung Association. (1998). *Indoor air pollution fact sheet: Household products* [Brochure].

American Lung Association. (1995). *Home indoor air quality checklist* [Brochure].

American Lung Association. (1995). *Indoor air pollution fact sheet: Formaldehyde*. [Brochure].

American Lung Association. (1994). *Indoor air pollution fact sheet: Combustion pollutants* [Brochure].

American Lung Association. (1993). *Indoor air pollution fact sheet: Secondhand smoke* [Brochure].

American Lung Association. (1990). *Indoor air pollution fact sheet: Asbestos* [Brochure].

Andrews, E. (1988). *Household cleaners and polishes — Chemical hazards in the home*. University of Wisconsin Extension Guide G3028.

Birdsong, C. (1992). *Mold and mildew in the home*. Colorado State University Cooperative Extension Guidesheet #9.501.

Bode, M., and Munson, D. (1995).

Controlling mold growth in the home. Kansas State University Extension Guide.

Bower, J. (1997). *The healthy house: How to buy one, how to build one, how to cure a sick one* (3rd ed.). Bloomington: IN: The Healthy House Institute.

Bower, L. M. (1995). *The healthy household*. Bloomington, IN: The Healthy House Institute.

Consumer Research Council. *How healthy is the air in your home? A room-by-room checklist for your home's indoor air* [Brochure].

Environmental Protection Agency. (1999). *Clear your home of asthma triggers* [Pamphlet]. Washington, DC: U.S. Government Printing Office.

Environmental Protection Agency. (1999). *Radon in drinking water: Questions and Answers* [Factsheet]. Washington, DC: U.S. Government Printing Office.

Environmental Protection Agency. (1996). *Protect your family and yourself from carbon monoxide poisoning*. Washington, DC: U.S. Government Printing Office.

Environmental Protection Agency. (1995). *Protect your family from lead in the home*. Washington, DC: U.S. Government Printing Office.

Environmental Protection Agency, United States Department of Agriculture, and Montana State University

Extension. (1996). *10 indoor air hazards every homeowner should know about*.

*Home*A*Syst, An Environmental Risk Assessment Guide for the Home*. A guide by the National Farm*A*Syst/ Home*A*Syst Program in cooperation with the Northeast Regional Agricultural Engineering Series (NRAES).

Institute of Medicine (2000). *Clearing the air: Asthma and indoor air exposures*. Washington DC: National Academy Press.

Leker, R. (1995). *Testing your house for radon*. North Carolina State University Extension Guide.

National Safety Council. *Teacher's guide to indoor air pollutants*.

The New York State Energy Research and Development Authority. *Homeowner's guide to ventilation* [Brochure]. Albany, NY: Author.

The New York State Energy Research and Development Authority and The New York State Department of Health. *Indoor air quality and your home: A guide to common indoor pollutants, their sources, and control methods* [Brochure]. Albany, NY: Author.

Yearn, M. (1995). *Healthy air at home — A checklist for parents*. Iowa State University Extension Guide.



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