The Inside Story: “A Guide to Indoor Air Quality"

United States Environmental Protection Agency and the
United States Consumer Product Safety Commission
Office of Radiation and Indoor Air (6604J)
EPA Document # 402-K-93-007, April 1995

DISCLAIMER

Information provided in this booklet is based on current scientific and technical understanding of the issues presented and is reflective of the jurisdictional boundaries established by the statutes governing the co-authoring agencies. Following the advice given will not necessarily provide complete protection in all situations or against all health hazards that may be caused by indoor air pollution.

INTRODUCTION **3**

INDOOR AIR QUALITY CONCERNS 3
WHY A BOOKLET ON INDOOR AIR? 3

INDOOR AIR QUALITY IN YOUR HOME **3**

WHAT CAUSES INDOOR AIR PROBLEMS? 3
Pollutant Sources *3*
Amount of Ventilation *4*
HOW DOES OUTDOOR AIR ENTER A HOUSE? 4
WHAT IF YOU LIVE IN AN APARTMENT? 4

IMPROVING THE AIR QUALITY IN YOUR HOME **4**

INDOOR AIR AND YOUR HEALTH 4
IDENTIFYING AIR QUALITY PROBLEMS 5
MEASURING POLLUTANT LEVELS 5
WEATHERIZING YOUR HOME 5
THREE BASIC STRATEGIES 6
Source Control *6*
Ventilation Improvements *6*
Air Cleaners *6*

A LOOK AT SOURCE-SPECIFIC CONTROLS **7**

RADON (RN) 7
ENVIRONMENTAL TOBACCO SMOKE (ETS) 8
BIOLOGICAL CONTAMINANTS 9
STOVES, HEATERS, FIREPLACES, AND CHIMNEYS 10
HOUSEHOLD PRODUCTS 11
FORMALDEHYDE 12
PESTICIDES 13
ASBESTOS 15
LEAD 17

WHAT ABOUT CARPET? **19**

WHEN BUILDING A NEW HOME **19**

DO YOU SUSPECT YOUR OFFICE HAS AN INDOOR AIR PROBLEM? **20**

HEALTH EFFECTS 20
WHAT CAUSES PROBLEMS? 20
Sources of Office Air Pollution *20*
Ventilation Systems *20*
Use of the Building *21*
WHAT TO DO IF YOU SUSPECT A PROBLEM 21

REFERENCE GUIDE TO MAJOR INDOOR AIR POLLUTANTS IN THE HOME **21**

RADON (RN) 22
ENVIRONMENTAL TOBACCO SMOKE (ETS) 22
BIOLOGICALS 22
CARBON MONOXIDE (CO) *23*
NITROGEN DIOXIDE (NO_2) *23*
ORGANIC GASES *23*
RESPIRABLE PARTICLES *24*
FORMALDEHYDE 24
PESTICIDES 24
ASBESTOS 25
LEAD 25

WHERE TO GO FOR ADDITIONAL INFORMATION ON INDOOR AIR QUALITY **25**

GLOSSARY OF TERMS **29**

HOW DO I ORDER A COPY OF THIS BOOKLET? **30**

Introduction

Indoor Air Quality Concerns

All of us face a variety of risks to our health as we go about our day-to-day lives. Driving in cars, flying in planes, engaging in recreational activities, and being exposed to environmental pollutants all pose varying degrees of risk. Some risks are simply unavoidable. Some we choose to accept because to do otherwise would restrict our ability to lead our lives the way we want. And some are risks we might decide to avoid if we had the opportunity to make informed choices. Indoor air pollution is one risk that you can do something about.

In the last several years, a growing body of scientific evidence has indicated that the air within homes and other buildings can be more seriously polluted than the outdoor air in even the largest and most industrialized cities. Other research indicates that people spend approximately 90 percent of their time indoors. Thus, for many people, the risks to health may be greater due to exposure to air pollution indoors than outdoors.

In addition, people who may be exposed to indoor air pollutants for the longest periods of time are often those most susceptible to the effects of indoor air pollution. Such groups include the young, the elderly, and the chronically ill, especially those suffering from respiratory or cardiovascular disease.

Why a Booklet on Indoor Air?

While pollutant levels from individual sources may not pose a significant health risk by themselves, most homes have more than one source that contributes to indoor air pollution. There can be a serious risk from the cumulative effects of these sources. Fortunately, there are steps that most people can take both to reduce the risk from existing sources and to prevent new problems from occurring. This booklet was prepared by the U.S. Environmental Protection Agency (EPA) and the U.S. Consumer Product Safety Commission (CPSC) to help you decide whether to take actions that can reduce the level of indoor air pollution in your own home.

Because so many Americans spend a lot of time in offices with mechanical heating, cooling, and ventilation systems, there is also a short section on the causes of poor air quality in offices and what you can do if you suspect that your office may have a problem. A glossary and a list of organizations where you can get additional information are available in this document.

Indoor Air Quality in Your Home

What Causes Indoor Air Problems?

Indoor pollution sources that release gases or particles into the air are the primary cause of indoor air quality problems in homes. Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources and by not carrying indoor air pollutants out of the home. High temperature and humidity levels can also increase concentrations of some pollutants.

Pollutant Sources

There are many sources of indoor air pollution in any home. These include combustion sources such as oil, gas, kerosene, coal, wood, and tobacco products; building materials and furnishings as diverse as deteriorated, asbestos-containing insulation, wet or damp carpet, and cabinetry or furniture made of certain pressed wood products; products for household cleaning and maintenance, personal care, or hobbies; central heating and cooling systems and humidification devices; and outdoor sources such as radon, pesticides, and outdoor air pollution.

The relative importance of any single source depends on how much of a given pollutant it emits and how hazardous those emissions are. In some cases, factors such as how old the source is and whether it is properly maintained are significant. For example, an improperly adjusted gas stove can emit significantly more carbon monoxide than one that is properly adjusted.

Some sources, such as building materials, furnishings, and household products like air fresheners, release pollutants more or less continuously. Other sources, related to activities carried out in the home, release pollutants intermittently. These include smoking, the use of unvented or malfunctioning stoves, furnaces, or space heaters, the use of solvents in cleaning and hobby activities, the use of paint strippers in redecorating activities, and the use of cleaning products and pesticides in housekeeping. High pollutant concentrations can remain in the air for long periods after some of these activities.

Amount of Ventilation

If too little outdoor air enters a home, pollutants can accumulate to levels that can pose health and comfort problems. Unless they are built with special mechanical means of ventilation, homes that are designed and constructed to minimize the amount of outdoor air that can "leak" into and out of the home may have higher pollutant levels than other homes. However, because some weather conditions can drastically reduce the amount of outdoor air that enters a home, pollutants can build up even in homes that are normally considered "leaky."

How Does Outdoor Air Enter a House?

Outdoor air enters and leaves a house by: infiltration, natural ventilation, and mechanical ventilation. In a process known as infiltration, outdoor air flows into the house through openings, joints, and cracks in walls, floors, and ceilings, and around windows and doors. In natural ventilation, air moves through opened windows and doors. Air movement associated with infiltration and natural ventilation is caused by air temperature differences between indoors and outdoors and by wind. Finally, there are a number of mechanical ventilation devices, from outdoor-vented fans that intermittently remove air from a single room, such as bathrooms and kitchen, to air handling systems that use fans and duct work to continuously remove indoor air and distribute filtered and conditioned outdoor air to strategic points throughout the house. The rate at which outdoor air replaces indoor air is described as the air exchange rate. When there is little infiltration, natural ventilation, or mechanical ventilation, the air exchange rate is low and pollutant levels can increase.

What If You Live in an Apartment?

Apartments can have the same indoor air problems as single-family homes because many of the pollution sources, such as the interior building materials, furnishings, and household products, are similar. Indoor air problems similar to those in offices are caused by such sources as contaminated ventilation systems, improperly placed outdoor air intakes, or maintenance activities.
Solutions to air quality problems in apartments, as in homes and offices, involve such actions as: eliminating or controlling the sources of pollution, increasing ventilation, and installing air cleaning devices. Often a resident can take the appropriate action to improve the indoor air quality by removing a source, altering an activity, unblocking an air supply vent, or opening a window to temporarily increase the ventilation; in other cases, however, only the building owner or manager is in a position to remedy the problem. (See the section "What to Do If You Suspect a Problem") You can encourage building management to follow guidance in EPA and NIOSH's Building Air Quality: A Guide for Building Owners and Facility Managers. To obtain the loose leaf format version of the Building Air Quality, complete with appendices, an index, and a full set of useful forms, and the newly released, Building Air Quality Action Plan, order GPO Stock # 055-000-00602-4, for $28, contact the: Superintendent of Documents, U.S. Government Printing Office (GPO), P.O. Box 371954, Pittsburgh, PA 15250-7954, or call (202) 512-1800, fax (202) 512-2250.

Improving the Air Quality in Your Home

Indoor Air and Your Health

Health effects from indoor air pollutants may be experienced soon after exposure or, possibly, years later.
Immediate effects may show up after a single exposure or repeated exposures. These include irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue. Such immediate effects are usually short-term and treatable. Sometimes the treatment is simply eliminating the person's exposure to the source of the pollution, if it can be identified. Symptoms of some diseases, including asthma, hypersensitivity pneumonitis, and humidifier fever, may also show up soon after exposure to some indoor air pollutants.
The likelihood of immediate reactions to indoor air pollutants depends on several factors. Age and preexisting medical conditions are two important influences. In other cases, whether a person reacts to a pollutant depends on individual sensitivity, which varies tremendously from person to person. Some people can become sensitized to biological pollutants after repeated exposures, and it appears that some people can become sensitized to chemical pollutants as well.
Certain immediate effects are similar to those from colds or other viral diseases, so it is often difficult to determine if the symptoms are a result of exposure to indoor air pollution. For this reason, it is important to pay attention to the time and place the symptoms occur. If the symptoms fade or go away when a person is away from the home and return when the person returns, an

effort should be made to identify indoor air sources that may be possible causes. Some effects may be made worse by an inadequate supply of outdoor air or from the heating, cooling, or humidity conditions prevalent in the home.

Other health effects may show up either years after exposure has occurred or only after long or repeated periods of exposure. These effects, which include some respiratory diseases, heart disease, and cancer, can be severely debilitating or fatal. It is prudent to try to improve the indoor air quality in your home even if symptoms are not noticeable. More information on potential health effects from particular indoor air pollutants is provided in the section, "A Look at Source-Specific Controls."

While pollutants commonly found in indoor air are responsible for many harmful effects, there is considerable uncertainty about what concentrations or periods of exposure are necessary to produce specific health problems. People also react very differently to exposure to indoor air pollutants. Further research is needed to better understand which health effects occur after exposure to the average pollutant concentrations found in homes and which occur from the higher concentrations that occur for short periods of time.

The health effects associated with some indoor air pollutants are summarized in the section "Reference Guide to Major Indoor Air Pollutants in the Home."

Identifying Air Quality Problems

Some health effects can be useful indicators of an indoor air quality problem, especially if they appear after a person moves to a new residence, remodels or refurnishes a home, or treats a home with pesticides. If you think that you have symptoms that may be related to your home environment, discuss them with your doctor or your local health department to see if they could be caused by indoor air pollution. You may also want to consult a board-certified allergist or an occupational medicine specialist for answers to your questions.

Another way to judge whether your home has or could develop indoor air problems is to identify potential sources of indoor air pollution. Although the presence of such sources does not necessarily mean that you have an indoor air quality problem, being aware of the type and number of potential sources is an important step toward assessing the air quality in your home.

A third way to decide whether your home may have poor indoor air quality is to look at your lifestyle and activities. Human activities can be significant sources of indoor air pollution. Finally, look for signs of problems with the ventilation in your home. Signs that can indicate your home may not have enough ventilation include moisture condensation on windows or walls, smelly or stuffy air, dirty central heating and air cooling equipment, and areas where books, shoes, or other items become moldy. To detect odors in your home, step outside for a few minutes, and then upon reentering your home, note whether odors are noticeable.

Measuring Pollutant Levels

The federal government recommends that you measure the level of radon in your home. Without measurements there is no way to tell whether radon is present because it is a colorless, odorless, radioactive gas. Inexpensive devices are available for measuring radon. EPA provides guidance as to risks associated with different levels of exposure and when the public should consider corrective action. There are specific mitigation techniques that have proven effective in reducing levels of radon in the home. (See "Radon" for additional information about testing and controlling radon in homes.)

For pollutants other than radon, measurements are most appropriate when there are either health symptoms or signs of poor ventilation and specific sources or pollutants have been identified as possible causes of indoor air quality problems. Testing for many pollutants can be expensive. Before monitoring your home for pollutants besides radon, consult your state or local health department or professionals who have experience in solving indoor air quality problems in non-industrial buildings.

Weatherizing Your Home

The federal government recommends that homes be weatherized in order to reduce the amount of energy needed for heating and cooling. While weatherization is underway, however, steps should also be taken to minimize pollution from sources inside the home. (See "Improving the Air Quality in Your Home" for recommended actions.) In addition, residents should be alert to the emergence of signs of inadequate ventilation, such as stuffy air, moisture condensation on cold surfaces, or mold and mildew growth. Additional weatherization measures should not be undertaken until these problems have been corrected.

Weatherization generally does not cause indoor air problems by adding new pollutants to the air. (There are a few exceptions, such as caulking, that can sometimes emit pollutants.) However, measures such as installing storm windows, weather stripping, caulking, and blown-in wall insulation can reduce the amount of outdoor air infiltrating into a home. Consequently, after weatherization, concentrations of indoor air pollutants from sources inside the home can increase.

Three Basic Strategies

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. Specific sources of indoor air pollution in your home are listed later in this section.

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.

It is particularly important to take as many of these steps as possible while you are involved in short-term activities that can generate high levels of pollutants--for example, painting, paint stripping, heating with kerosene heaters, cooking, or engaging in maintenance and hobby activities such as welding, soldering, or sanding. You might also choose to do some of these activities outdoors, if you can and if weather permits.

Advanced designs of new homes are starting to feature mechanical systems that bring outdoor air into the home. Some of these designs include energy-efficient heat recovery ventilators (also known as air-to-air heat exchangers). For more information about air-to-air heat exchangers, contact the Conservation and Renewable Energy Inquiry and Referral Service (CAREIRS), PO Box 3048, Merrifield, VA 22116.

Air Cleaners

There are many types and sizes of air cleaners on the market, ranging from relatively inexpensive table-top models to sophisticated and expensive whole-house systems. Some air cleaners are highly effective at particle removal, while others, including most table-top 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. Table-top 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.

Over the past few years, there has been some publicity suggesting that houseplants have been shown to reduce levels of some chemicals in laboratory experiments. There is currently no evidence, however, that a reasonable number of houseplants remove significant quantities of pollutants in homes and offices. Indoor houseplants should not be over-watered because overly damp soil may promote the growth of microorganisms which can affect allergic individuals.

At present, EPA does not recommend using air cleaners to reduce levels of radon and its decay products. The effectiveness of these devices is uncertain because they only partially remove the radon decay products and do not diminish the amount of radon entering the home. EPA plans to do additional research on whether air cleaners are, or could become, a reliable means of reducing the health risk from radon. EPA's booklet, Residential Air-Cleaning Devices, provides further information on air-cleaning devices to reduce indoor air pollutants.

For most indoor air quality problems in the home, source control is the most effective solution. This section takes a source-by-source look at the most common indoor air pollutants, their potential health effects, and ways to reduce levels in the home. (For a summary of the points made in this section, see the section entitled "Reference Guide to Major Indoor Air Pollutants in the Home.") EPA has recently released, Ozone Generators That Are Sold As Air Cleaners. The purpose of this document (which is only available via this web site) is to provide accurate information regarding the use of ozone-generating devices in indoor occupied spaces. This information is based on the most credible scientific evidence currently available.

EPA has recently published, "Should You Have the Air Ducts in Your Home Cleaned?" EPA-402-K-97-002, October 1997. This document is intended to help consumers answer this often confusing question. The document explains what air duct cleaning is, provides guidance to help consumers decide whether to have the service performed in their home, and provides helpful information for choosing a duct cleaner, determining if duct cleaning was done properly, and how to prevent contamination of air ducts.

A Look at Source-Specific Controls

RADON (Rn)

The most common source of indoor radon is uranium in the soil or rock on which homes are built. As uranium naturally breaks down, it releases radon gas which is a colorless, odorless, radioactive gas. Radon gas enters homes through dirt floors, cracks in concrete walls and floors, floor drains, and sumps. When radon becomes trapped in buildings and concentrations build up indoors, exposure to radon becomes a concern.

Any home may have a radon problem. This means new and old homes, well-sealed and drafty homes, and homes with or without basements.

Sometimes radon enters the home through well water. In a small number of homes, the building materials can give off radon, too. However, building materials rarely cause radon problems by themselves.

Health Effects of Radon

The predominant health effect associated with exposure to elevated levels of radon is lung cancer. Research suggests that swallowing water with high radon levels may pose risks, too, although these are believed to be much lower than those from breathing air containing radon. Major health organizations (like the Centers for Disease Control and Prevention, the American Lung Association (ALA), and the American Medical Association) agree with estimates that radon causes thousands of preventable lung cancer deaths each year. EPA estimates that radon causes about 14,000 deaths per year in the United States--however, this number could range from 7,000 to 30,000 deaths per year. If you smoke and your home has high radon levels, your risk of lung cancer is especially high.

Reducing Exposure to Radon in Homes

Measure levels of radon in your home.

You can't see radon, but it's not hard to find out if you have a radon problem in your home. Testing is easy and should only take a little of your time. There are many kinds of inexpensive, do-it-yourself radon test kits you can get through the mail and in hardware stores and other retail outlets. EPA recommends that consumers use test kits that are state-certified or have met the requirements of some national radon proficiency program. For more information on EPA's former National Radon Proficiency Program (RPP), visit the Radon web site. If you prefer, or if you are buying or selling a home, you can hire a trained contractor to do the testing for you. EPA provided a list of companies and individual contractors on this web site which was also available to state radon offices. Our program closed on 9/30/98. You should call your state radon office to obtain a list of qualified contractors in your area. You can also contact either the National Environmental Health Association (NEHA) - http://www.neha.org **Error! Bookmark not defined.** or the National Radon Safety Board (NRSB) - http://www.nrsb.org or a list of proficient radon measurement and/or mitigation contractors.

Refer to the EPA guidelines on how to test and interpret your test results.

You can learn more about radon through EPA's publications, *A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family From Radon* and *Home Buyer's and Seller's Guide to Radon*, which are also available from your state radon office.

Learn about radon reduction methods.

Ways to reduce radon in your home are discussed in EPA's *Consumer's Guide to Radon Reduction*. You can get a copy from your state radon office. There are simple solutions to radon problems in homes. Thousands of homeowners have already fixed radon problems. Lowering high radon levels requires technical knowledge and special skills. You should use a contractor who is trained to fix radon problems.

A trained radon reduction contractor can study the problem in your home and help you pick the correct treatment method. Check with your state radon office for names of qualified or state-certified radon-reduction contractors in your area.

Stop smoking and discourage smoking in your home.

Scientific evidence indicates that smoking combined with radon is an especially serious health risk. Stop smoking and lower your radon level to reduce lung cancer risk.

Treat radon-contaminated well water.

While radon in water is not a problem in homes served by most public water supplies, it has been found in well water. If you've tested the air in your home and found a radon problem, and you have a well, contact a lab certified to measure radiation in water to have your water tested. Radon problems in water can be readily fixed. Call your state radon office or the EPA Drinking Water Hotline (800-426-4791) for more information.

ENVIRONMENTAL TOBACCO SMOKE (ETS)

Environmental tobacco smoke (ETS) is the mixture of smoke that comes from the burning end of a cigarette, pipe, or cigar, and smoke exhaled by the smoker. It is a complex mixture of over 4,000 compounds, more than 40 of which are known to cause cancer in humans or animals and many of which are strong irritants. ETS is often referred to as "secondhand smoke" and exposure to ETS is often called "passive smoking."

Health Effects of Environmental Tobacco Smoke

In 1992, EPA completed a major assessment of the respiratory health risks of ETS (Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders EPA/600/6-90/006F). The report concludes that exposure to ETS is responsible for approximately 3,000 lung cancer deaths each year in nonsmoking adults and impairs the respiratory health of hundreds of thousands of children.

Infants and young children whose parents smoke in their presence are at increased risk of lower respiratory tract infections (pneumonia and bronchitis) and are more likely to have symptoms of respiratory irritation like cough, excess phlegm, and wheeze. EPA estimates that passive smoking annually causes between 150,000 and 300,000 lower respiratory tract infections in infants and children under 18 months of age, resulting in between 7,500 and 15,000 hospitalizations each year. These children may also have a build-up of fluid in the middle ear, which can lead to ear infections. Older children who have been exposed to secondhand smoke may have slightly reduced lung function.

Asthmatic children are especially at risk. EPA estimates that exposure to secondhand smoke increases the number of episodes and severity of symptoms in hundreds of thousands of asthmatic children, and may cause thousands of non-asthmatic children to develop the disease each year. EPA estimates that between 200,000 and 1,000,000 asthmatic children have their condition made worse by exposure to secondhand smoke each year. Exposure to secondhand smoke causes eye, nose, and throat irritation. It may affect the cardiovascular system and some studies have linked exposure to secondhand smoke with the onset of chest pain. For publications about ETS, go to Smoke Free Homes web site, the IAQ Publications page, or contact EPA's Indoor Air Quality Information Clearinghouse (IAQ INFO), 800-438-4318 or (703) 356-4020.

Reducing Exposure to Environmental Tobacco Smoke

Don't smoke at home or permit others to do so. Ask smokers to smoke outdoors.

The 1986 Surgeon General's report concluded that physical separation of smokers and nonsmokers in a common air space, such as different rooms within the same house, may reduce - but will not eliminate - non-smokers' exposure to environmental tobacco smoke.

If smoking indoors cannot be avoided, increase ventilation in the area where smoking takes place.

Open windows or use exhaust fans. Ventilation, a common method of reducing exposure to indoor air pollutants, also will reduce but not eliminate exposure to environmental tobacco smoke. Because smoking produces such large amounts of pollutants, natural or mechanical ventilation techniques do not remove them from the air in your home as quickly as they build up. In addition, the large increases in ventilation it takes to significantly reduce exposure to environmental tobacco smoke can also increase energy costs substantially. Consequently, the most effective way to reduce exposure to environmental tobacco smoke in the home is to eliminate smoking there.

Do not smoke if children are present, particularly infants and toddlers.

Children are particularly susceptible to the effects of passive smoking. Do not allow baby-sitters or others who work in your home to smoke indoors. Discourage others from smoking around children. Find out about the smoking policies of the day care center providers, schools, and other care givers for your children. The policy should protect children from exposure to ETS.

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.
To learn more about biological pollutants, read Biological Pollutants in Your Home issued by the U.S. Consumer Product Safety Commission and the American Lung Association. For contact information, see the section, "Where to Go For Additional Information."

STOVES, HEATERS, FIREPLACES, AND CHIMNEYS

In addition to environmental tobacco smoke, other sources of combustion products are unvented kerosene and gas space heaters, woodstoves, fireplaces, and gas stoves. The major pollutants released are carbon monoxide, nitrogen dioxide, and particles. Unvented kerosene heaters may also generate acid aerosols.
Combustion gases and particles also come from chimneys and flues that are improperly installed or maintained and cracked furnace heat exchangers. Pollutants from fireplaces and woodstoves with no dedicated outdoor air supply can be "back-drafted" from the chimney into the living space, particularly in weatherized homes.

Health Effects of Combustion Products

Carbon monoxide (CO) is a colorless, odorless gas that interferes with the delivery of oxygen throughout the body. At high concentrations it can cause unconsciousness and death. Lower concentrations can cause a range of symptoms from headaches, dizziness, weakness, nausea, confusion, and disorientation, to fatigue in healthy people and episodes of increased chest pain in people with chronic heart disease. The symptoms of carbon monoxide poisoning are sometimes confused with the flu or food poisoning. Fetuses, infants, elderly people, and people with anemia or with a history of heart or respiratory disease can be especially sensitive to carbon monoxide exposures.
Nitrogen dioxide (NO2) is a colorless, odorless gas that irritates the mucous membranes in the eye, nose, and throat and causes shortness of breath after exposure to high concentrations. There is evidence that high concentrations or continued exposure to low levels of nitrogen dioxide increases the risk of respiratory infection; there is also evidence from animal studies that repeated exposures to elevated nitrogen dioxide levels may lead, or contribute, to the development of lung disease such as emphysema. People at particular risk from exposure to nitrogen dioxide include children and individuals with asthma and other respiratory diseases.
Particles, released when fuels are incompletely burned, can lodge in the lungs and irritate or damage lung tissue. A number of pollutants, including radon and benzo(a)pyrene, both of which can cause cancer, attach to small particles that are inhaled and then carried deep into the lung.

Reducing Exposure to Combustion Products in Homes

Take special precautions when operating fuel-burning unvented space heaters.

Consider potential effects of indoor air pollution if you use an unvented kerosene or gas space heater. Follow the manufacturer's directions, especially instructions on the proper fuel and keeping the heater properly adjusted. A persistent yellow-tipped flame is generally an indicator of maladjustment and increased pollutant emissions. While a space heater is in use, open a door from the room where the heater is located to the rest of the house and open a window slightly.

Install and use exhaust fans over gas cooking stoves and ranges and keep the burners properly adjusted.

Using a stove hood with a fan vented to the outdoors greatly reduces exposure to pollutants during cooking. Improper adjustment, often indicated by a persistent yellow-tipped flame, causes increased pollutant emissions. Ask your gas company to adjust the burner so that the flame tip is blue. If you purchase a new gas stove or range, consider buying one with pilotless ignition because it does not have a pilot light that burns continuously. Never use a gas stove to heat your home. Always make certain the flue in your gas fireplace is open when the fireplace is in use.

Keep woodstove emissions to a minimum. Choose properly sized new stoves that are certified as meeting EPA emission standards.

Make certain that doors in old woodstoves are tight-fitting. Use aged or cured (dried) wood only and follow the manufacturer's directions for starting, stoking, and putting out the fire in woodstoves. Chemicals are used to pressure-treat wood; such wood should never be burned indoors. (Because some old gaskets in woodstove doors contain asbestos, when replacing gaskets refer to the instructions in the CPSC, ALA, and EPA booklet, Asbestos in Your Home, to avoid creating an asbestos problem. New gaskets are made of fiberglass.)

Have central air handling systems, including furnaces, flues, and chimneys, inspected annually and promptly repair cracks or damaged parts.

Blocked, leaking, or damaged chimneys or flues release harmful combustion gases and particles and even fatal concentrations of carbon monoxide. Strictly follow all service and maintenance procedures recommended by the manufacturer, including those that tell you how frequently to change the filter. If manufacturer's instructions are not readily available, change filters once every month or two during periods of use. Proper maintenance is important even for new furnaces because they can also corrode and leak combustion gases, including carbon monoxide.
Read the booklet What You Should Know About Combustion Appliances and Indoor Air Pollution to learn more about combustion pollutants. The booklet is available by contacting CPSC, EPA's IAQ INFO Clearinghouse, or your local ALA. (See "Where to Go for Additional Information" for contact information.)

HOUSEHOLD PRODUCTS

Organic chemicals are widely used as ingredients in household products. Paints, varnishes, and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic, degreasing, and hobby products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and, to some degree, when they are stored.
EPA's Total Exposure Assessment Methodology (TEAM) studies found levels of about a dozen common organic pollutants to be 2 to 5 times higher inside homes than outside, regardless of whether the homes were located in rural or highly industrial areas. Additional TEAM studies indicate that while people are using products containing organic chemicals, they can expose themselves and others to very high pollutant levels, and elevated concentrations can persist in the air long after the activity is completed.

Health Effects of Household Chemicals

The ability of organic chemicals to cause health effects varies greatly, from those that are highly toxic, to those with no known health effect. As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics. At present, not much is known about what health effects occur from the levels of organics usually found in homes. Many organic compounds are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans.

Reducing Exposure to Household Chemicals

Follow label instructions carefully.

Potentially hazardous products often have warnings aimed at reducing exposure of the user. For example, if a label says to use the product in a well-ventilated area, go outdoors or in areas equipped with an exhaust fan to use it. Otherwise, open up windows to provide the maximum amount of outdoor air possible.

Throw away partially full containers of old or unneeded chemicals safely.

Because gases can leak even from closed containers, this single step could help lower concentrations of organic chemicals in your home. (Be sure that materials you decide to keep are stored not only in a well-ventilated area but are also safely out of reach of children.) Do not simply toss these unwanted products in the garbage can. Find out if your local government or any organization in your community sponsors special days for the collection of toxic household wastes. If such days are available, use them to dispose of the unwanted containers safely. If no such collection days are available, think about organizing one.

Buy limited quantities.

If you use products only occasionally or seasonally, such as paints, paint strippers, and kerosene for space heaters or gasoline for lawn mowers, buy only as much as you will use right away.

Keep exposure to emissions from products containing methylene chloride to a minimum.

Consumer products that contain **methylene chloride** include paint strippers, adhesive removers, and aerosol spray paints. Methylene chloride is known to cause cancer in animals. Also, methylene chloride is converted to carbon monoxide in the body and can cause symptoms associated with exposure to carbon monoxide. Carefully read the labels containing health hazard information and cautions on the proper use of these products. Use products that contain methylene chloride outdoors when possible; use indoors only if the area is well ventilated.

Keep exposure to benzene to a minimum.

Benzene is a known human carcinogen. The main indoor sources of this chemical are environmental tobacco smoke, stored fuels and paint supplies, and automobile emissions in attached garages. Actions that will reduce benzene exposure include eliminating smoking within the home, providing for maximum ventilation during painting, and discarding paint supplies and special fuels that will not be used immediately.

Keep exposure to perchloroethylene emissions from newly dry-cleaned materials to a minimum.

Perchloroethylene is the chemical most widely used in dry cleaning. In laboratory studies, it has been shown to cause cancer in animals. Recent studies indicate that people breathe low levels of this chemical both in homes where dry-cleaned goods are stored and as they wear dry-cleaned clothing. Dry cleaners recapture the perchloroethylene during the dry-cleaning process so they can save money by re-using it, and they remove more of the chemical during the pressing and finishing processes. Some dry cleaners, however, do not remove as much perchloroethylene as possible all of the time. Taking steps to minimize your exposure to this chemical is prudent. If dry-cleaned goods have a strong chemical odor when you pick them up, do not accept them until they have been properly dried. If goods with a chemical odor are returned to you on subsequent visits, try a different dry cleaner.

FORMALDEHYDE

Formaldehyde is an important chemical used widely by industry to manufacture building materials and numerous household products. It is also a by-product of combustion and certain other natural processes. Thus, it may be present in substantial concentrations both indoors and outdoors.

Sources of formaldehyde in the home include building materials, smoking, household products, and the use of unvented, fuel-burning appliances, like gas stoves or kerosene space heaters. Formaldehyde, by itself or in combination with other chemicals, serves a number of purposes in manufactured products. For example, it is used to add permanent-press qualities to clothing and draperies, as a component of glues and adhesives, and as a preservative in some paints and coating products.

In homes, the most significant sources of formaldehyde are likely to be pressed wood products made using adhesives that contain urea-formaldehyde (UF) resins. Pressed wood products made for indoor use include: particleboard (used as subflooring and shelving and in cabinetry and furniture); hardwood plywood paneling (used for decorative wall covering and used in cabinets and furniture); and medium density fiberboard (used for drawer fronts, cabinets, and furniture tops). Medium density fiberboard contains a higher resin-to-wood ratio than any other UF pressed wood product and is generally recognized as being the highest formaldehyde-emitting pressed wood product.

Other pressed wood products, such as softwood plywood and flake or oriented strandboard, are produced for exterior construction use and contain the dark, or red/black-colored phenol-formaldehyde (PF) resin. Although formaldehyde is present in both types of resins, pressed woods that contain PF resin generally emit formaldehyde at considerably lower rates than those containing UF resin.

Since 1985, the Department of Housing and Urban Development (HUD) has permitted only the use of plywood and particleboard that conform to specified formaldehyde emission limits in the construction of prefabricated and mobile homes. In the past, some of these homes had elevated levels of formaldehyde because of the large amount of high-emitting pressed wood products used in their construction and because of their relatively small interior space.

The rate at which products like pressed wood or textiles release formaldehyde can change. Formaldehyde emissions will generally decrease as products age. When the products are new, high indoor temperatures or humidity can cause increased release of formaldehyde from these products.

During the 1970s, many homeowners had urea-formaldehyde foam insulation (UFFI) installed in the wall cavities of their homes as an energy conservation measure. However, many of these homes were found to have relatively high indoor concentrations of formaldehyde soon after the UFFI installation. Few homes are now being insulated with this product. Studies show that formaldehyde emissions from UFFI decline with time; therefore, homes in which UFFI was installed many years ago are unlikely to have high levels of formaldehyde now.

Health Effects of Formaldehyde

Formaldehyde, a colorless, pungent-smelling gas, can cause watery eyes, burning sensations in the eyes and throat, nausea, and difficulty in breathing in some humans exposed at elevated levels (above 0.1 parts per million). High concentrations may trigger attacks in people with asthma. There is evidence that some people can develop a sensitivity to formaldehyde. It has also been shown to cause cancer in animals and may cause cancer in humans.

Reducing Exposure to Formaldehyde in Homes

Ask about the formaldehyde content of pressed wood products, including building materials, cabinetry, and furniture before you purchase them.

If you experience adverse reactions to formaldehyde, you may want to avoid the use of pressed wood products and other formaldehyde-emitting goods. Even if you do not experience such reactions, you may wish to reduce your exposure as much as possible by purchasing exterior-grade products, which emit less formaldehyde. For further information on formaldehyde and consumer products, call the EPA Toxic Substance Control Act (TSCA) assistance line (202-554-1404).

Some studies suggest that coating pressed wood products with polyurethane may reduce formaldehyde emissions for some period of time. To be effective, any such coating must cover all surfaces and edges and remain intact. Increase the ventilation and carefully follow the manufacturer instructions while applying these coatings. (If you are sensitive to formaldehyde, check the label contents before purchasing coating products to avoid buying products that contain formaldehyde, as they will emit the chemical for a short time after application.) Maintain moderate temperature and humidity levels and provide adequate ventilation. The rate at which formaldehyde is released is accelerated by heat and may also depend somewhat on the humidity level. Therefore, the use of dehumidifiers and air conditioning to control humidity and to maintain a moderate temperature can help reduce formaldehyde emissions. (Drain and clean dehumidifier collection trays frequently so that they do not become a breeding ground for microorganisms.) Increasing the rate of ventilation in your home will also help in reducing formaldehyde levels.

PESTICIDES

According to a recent survey, 75 percent of U.S. households used at least one pesticide product indoors during the past year. Products used most often are insecticides and disinfectants. Another study suggests that 80 percent of most people's exposure to pesticides occurs indoors and that measurable levels of up to a dozen pesticides have been found in the air inside homes. The amount of pesticides found in homes appears to be greater than can be explained by recent pesticide use in those households; other possible sources include contaminated soil or dust that floats or is tracked in from outside, stored pesticide containers, and

household surfaces that collect and then release the pesticides. Pesticides used in and around the home include products to control insects (insecticides), termites (termiticides), rodents (rodenticides), fungi (fungicides), and microbes (disinfectants). They are sold as sprays, liquids, sticks, powders, crystals, balls, and foggers.

In 1990, the American Association of Poison Control Centers reported that some 79,000 children were involved in common household pesticide poisonings or exposures. In households with children under five years old, almost one-half stored at least one pesticide product within reach of children.

EPA registers pesticides for use and requires manufacturers to put information on the label about when and how to use the pesticide. It is important to remember that the "-cide" in pesticides means "to kill." *These products can be dangerous if not used properly*.

In addition to the active ingredient, pesticides are also made up of ingredients that are used to carry the active agent. These carrier agents are called "inerts" in pesticides because they are not toxic to the targeted pest; nevertheless, some inerts are capable of causing health problems.

Health Effects From Pesticides

Both the active and inert ingredients in pesticides can be organic compounds; therefore, both could add to the levels of airborne organics inside homes. Both types of ingredients can cause the effects discussed in this document under "Household Products," however, as with other household products, there is insufficient understanding at present about what pesticide concentrations are necessary to produce these effects.

Exposure to high levels of cyclodiene pesticides, commonly associated with misapplication, has produced various symptoms, including headaches, dizziness, muscle twitching, weakness, tingling sensations, and nausea. In addition, EPA is concerned that cyclodienes might cause long-term damage to the liver and the central nervous system, as well as an increased risk of cancer.

There is no further sale or commercial use permitted for the following cyclodiene or related pesticides: chlordane, aldrin, dieldrin, and heptachlor. The only exception is the use of heptachlor by utility companies to control fire ants in underground cable boxes.

Reducing Exposure to Pesticides in Homes

Read the label and follow the directions. It is illegal to use any pesticide in any manner inconsistent with the directions on its label.

Unless you have had special training and are certified, never use a pesticide that is restricted to use by state-certified pest control operators. Such pesticides are simply too dangerous for application by a non-certified person. Use only the pesticides approved for use by the general public and then only in recommended amounts; increasing the amount does not offer more protection against pests and can be harmful to you and your plants and pets.

Ventilate the area well after pesticide use.

Mix or dilute pesticides outdoors or in a well-ventilated area and only in the amounts that will be immediately needed. If possible, take plants and pets outside when applying pesticides to them.

Use non-chemical methods of pest control when possible.

Since pesticides can be found far from the site of their original application, it is prudent to reduce the use of chemical pesticides outdoors as well as indoors. Depending on the site and pest to be controlled, one or more of the following steps can be effective: use of biological pesticides, such as Bacillus thuringiensis, for the control of gypsy moths; selection of disease-resistant plants; and frequent washing of indoor plants and pets. Termite damage can be reduced or prevented by making certain that wooden building materials do not come into direct contact with the soil and by storing firewood away from the home. By appropriately fertilizing, watering, and aerating lawns, the need for chemical pesticide treatments of lawns can be dramatically reduced.

If you decide to use a pest control company, choose one carefully.

Ask for an inspection of your home and get a written control program for evaluation before you sign a contract. The control program should list specific names of pests to be controlled and chemicals to be used; it should also reflect any of your safety concerns. Insist on a proven record of competence and customer satisfaction.

Dispose of unwanted pesticides safely.

If you have unused or partially used pesticide containers you want to get rid of, dispose of them according to the directions on the label or on special household hazardous waste collection days. If there are no such collection days in your community, work with others to organize them.

Keep exposure to moth repellents to a minimum.

One pesticide often found in the home is paradichlorobenzene, a commonly used active ingredient in moth repellents. This chemical is known to cause cancer in animals, but substantial scientific uncertainty exists over the effects, if any, of long-term human exposure to paradichlorobenzene. EPA requires that products containing paradichlorobenzene bear warnings such as "avoid breathing vapors" to warn users of potential short-term toxic effects. Where possible, paradichlorobenzene, and items to be protected against moths, should be placed in trunks or other containers that can be stored in areas that are separately ventilated from the home, such as attics and detached garages. Paradichlorobenzene is also the key active ingredient in many air fresheners (in fact, some labels for moth repellents recommend that these same products be used as air fresheners or deodorants). Proper ventilation and basic household cleanliness will go a long way toward preventing unpleasant odors.

Call the National Pesticide Telecommunications Network (NPTN).

EPA sponsors the NPTN (800-858-PEST) to answer your questions about pesticides and to provide selected EPA publications on pesticides.

ASBESTOS

Asbestos is a mineral fiber that has been used commonly in a variety of building construction materials for insulation and as a fire-retardant. EPA and CPSC have banned several asbestos products. Manufacturers have also voluntarily limited uses of asbestos. Today, asbestos is most commonly found in older homes, in pipe and furnace insulation materials, asbestos shingles, millboard, textured paints and other coating materials, and floor tiles.
Elevated concentrations of airborne asbestos can occur after asbestos-containing materials are disturbed by cutting, sanding or other remodeling activities. Improper attempts to remove these materials can release asbestos fibers into the air in homes, increasing asbestos levels and endangering people living in those homes.

Health Effects of Asbestos

The most dangerous asbestos fibers are too small to be visible. After they are inhaled, they can remain and accumulate in the lungs. Asbestos can cause lung cancer, mesothelioma (a cancer of the chest and abdominal linings), and asbestosis (irreversible lung scarring that can be fatal). Symptoms of these diseases do not show up until many years after exposure began. Most people with asbestos-related diseases were exposed to elevated concentrations on the job; some developed disease from exposure to clothing and equipment brought home from job sites.

Reducing Exposure to Asbestos in Homes

Learn how asbestos problems are created in homes.

Read the booklet, Asbestos in Your Home, issued by CPSC, the ALA, and EPA. To contact these organizations, see the section, "Where to Go For More Information."

If you think your home may have asbestos, don't panic!

Usually it is best to leave asbestos material that is in good condition alone. Generally, material in good condition will not release asbestos fiber. There is no danger unless fibers are released and inhaled into the lungs.

Do not cut, rip, or sand asbestos-containing materials.

Leave undamaged materials alone and, to the extent possible, prevent them from being damaged, disturbed, or touched. Periodically inspect for damage or deterioration. Discard damaged or worn asbestos gloves, stove-top pads, or ironing board covers. Check with local health, environmental, or other appropriate officials to find out about 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.

When you need to remove or clean up asbestos, use a professionally trained contractor.

Select a contractor only after careful discussion of the problems in your home and the steps the contractor will take to clean up or remove them. Consider the option of sealing off the materials instead of removing them.
Call EPA's TSCA assistance line at (202) 554-1404 to find out whether your state has a training and certification program for asbestos removal contractors and for information on EPA's asbestos programs.
Toxic Substances Control Act (TSCA) Hotline - Sponsored by the Office of Pollution Prevention and Toxics, the TSCA Hotline provides technical assistance and information about asbestos programs implemented under TSCA, which include; the Asbestos School Hazard Abatement Act (ASHAA), the Asbestos Hazard Emergency Response Act (AHERA), and the Asbestos School Hazard Abatement Reauthorization Act (ASHARA). The Hotline provides copies of TSCA information, such as Federal Register notices and support documents, to requesters through its Clearinghouse function.

E-mail address: tsca-hotline@epa.gov
Hours of Service: 8:30 a.m. - 5:00 p.m. (EST) M - F
Telephone: (202) 554-1404
TDD: (202) 554-0551
Fax: (202) 554-5603 (Fax available 24 hours a day)

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 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. For more information on health effects, get a copy of the Centers for Disease Control's, Preventing Lead Poisoning in Young Children (October 1991).

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, nap time, 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.
For additional information dealing with lead-based paint abatement contact the Department of Housing and Urban Development for the following two documents: Comprehensive and Workable Plan for the Abatement of Lead-Based Paint in Privately Owned Housing: Report to Congress (December 7, 1990) and Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing (September 1990).

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 door mats 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 which 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. Send for the EPA pamphlet, Lead and Your Drinking Water, for more information about what you can do if you have lead in your drinking water. Call EPA's Safe Drinking Water Hotline (800-426-4791) for more information.

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.
You can get a brochure, Lead Poisoning and Your Children, and more information by calling the National Lead Information Center, 800-LEAD-FYI.

What About Carpet?

In recent years, a number of consumers have associated a variety of symptoms with the installation of new carpet. Scientists have not been able to determine whether the chemicals emitted by new carpets are responsible. If you are installing new carpet, you may wish to take the following steps:

- Talk to your carpet retailer. Ask for information on emissions from carpet.
- Ask the retailer to unroll and air out the carpet in a well-ventilated area before installation.
- Ask for low-emitting adhesives if adhesives are needed.
- Consider leaving the premises during and immediately after carpet installation. You may wish to schedule the installation when most family members or office workers are out.
- Be sure the retailer requires the installer to follow the Carpet and Rug Institute's installation guidelines.
- Open doors and windows. Increasing the amount of fresh air in the home will reduce exposure to most chemicals released from carpet. During and after installation, use window fans, room air conditioners, or other mechanical ventilation equipment you may have installed in your house, to exhaust fumes to the outdoors. Keep them running for 48 to 72 hours after the new carpet is installed.
- Contact your carpet retailer if objectionable odors persist.
- Follow the manufacturer's instructions for proper carpet maintenance.

When Building a New Home

Building a new home provides the opportunity for preventing indoor air problems. However, it can result in exposure to higher levels of indoor air contaminants if careful attention is not given to potential pollution sources and the air exchange rate.

Express your concerns about indoor air quality to your architect or builder and enlist his or her cooperation in taking measures to provide good indoor air quality. Talk both about purchasing building materials and furnishings that are low-emitting and about providing an adequate amount of ventilation.

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends a ventilation rate of 0.35 ach (air changes per hour) for new homes, and some new homes are built to even tighter specifications. Particular care should be given in such homes to preventing the build-up of indoor air pollutants to high levels.

Here are a few important actions that can make a difference:

- Use radon-resistant construction techniques.
- Obtain a copy of the EPA booklet, Model Standards and Techniques for Control of Radon in New Residential Buildings, from your state radon office or health agency, your state homebuilders' association, or your EPA regional office. [You can also visit EPA's Radon Resistant New Construction (RRNC)].
- Choose building materials and furnishings that will keep indoor air pollution to a minimum.

There are many actions a homeowner can take to select products that will prevent indoor air problems from occurring - a couple of them are mentioned here. First, use exterior-grade pressed wood products made with phenol-formaldehyde resin in floors, cabinetry, and wall surfaces. Or, as an alternative, consider using solid wood products. Secondly, if you plan to install wall-to-wall carpet on concrete in contact with the ground, especially concrete in basements, make sure that an effective moisture barrier is installed prior to installing the carpet. Do not permanently adhere carpet to concrete with adhesives so that the carpet can be removed if it becomes wet.

- Provide proper drainage and seal foundations in new construction.
- Air that enters the home through the foundation can contain more moisture than is generated from all occupant activities.
- Become familiar with mechanical ventilation systems and consider installing one.
- Advanced designs of new homes are starting to feature mechanical systems that bring outdoor air into the home. Some of these designs include energy-efficient heat recovery ventilators (also known as air-to-air heat exchangers).
- Ensure that combustion appliances, including furnaces, fireplaces, woodstoves, and heaters, are properly vented and receive enough supply air.
- Combustion gases, including carbon monoxide, and particles can be back-drafted from the chimney or flue into the living space if the combustion appliance is not properly vented or does not receive enough supply air. Back-drafting can be a particular problem in weatherized or tightly constructed homes. Installing a dedicated outdoor air supply for the combustion appliance can help prevent backdrafting.

Do You Suspect Your Office has an Indoor Air Problem?

Indoor air quality problems are not limited to homes. In fact, many office buildings have significant air pollution sources. Some of these buildings may be inadequately ventilated. For example, mechanical ventilation systems may not be designed or operated to provide adequate amounts of outdoor air. Finally, people generally have less control over the indoor environment in their offices than they do in their homes. As a result, there has been an increase in the incidence of reported health problems.

Health Effects

A number of well-identified illnesses, such as Legionnaires' disease, asthma, hypersensitivity pneumonitis, and humidifier fever, have been directly traced to specific building problems. These are called building-related illnesses. Most of these diseases can be treated, nevertheless, some pose serious risks.

Sometimes, however, building occupants experience symptoms that do not fit the pattern of any particular illness and are difficult to trace to any specific source. This phenomenon has been labeled sick building syndrome. People may complain of one or more of the following symptoms: dry or burning mucous membranes in the nose, eyes, and throat; sneezing; stuffy or runny nose; fatigue or lethargy; headache; dizziness; nausea; irritability and forgetfulness. Poor lighting, noise, vibration, thermal discomfort, and psychological stress may also cause, or contribute to, these symptoms.

There is no single manner in which these health problems appear. In some cases, problems begin as workers enter their offices and diminish as workers leave; other times, symptoms continue until the illness is treated. Sometimes there are outbreaks of illness among many workers in a single building; in other cases, health symptoms show up only in individual workers.

In the opinion of some World Health Organization experts, up to 30 percent of new or remodeled commercial buildings may have unusually high rates of health and comfort complaints from occupants that may potentially be related to indoor air quality.

What Causes Problems?

Three major reasons for poor indoor air quality in office buildings are the presence of indoor air pollution sources; poorly designed, maintained, or operated ventilation systems; and uses of the building that were unanticipated or poorly planned for when the building was designed or renovated.

Sources of Office Air Pollution

As with homes, the most important factor influencing indoor air quality is the presence of pollutant sources. Commonly found office pollutants and their sources include environmental tobacco smoke; asbestos from insulating and fire-retardant building supplies; formaldehyde from pressed wood products; other organics from building materials, carpet, and other office furnishings, cleaning materials and activities, restroom air fresheners, paints, adhesives, copying machines, and photography and print shops; biological contaminants from dirty ventilation systems or water-damaged walls, ceilings, and carpets; and pesticides from pest management practices.

Ventilation Systems

Mechanical ventilation systems in large buildings are designed and operated not only to heat and cool the air, but also to draw in and circulate outdoor air. If they are poorly designed, operated, or maintained, however, ventilation systems can contribute to indoor air problems in several ways.

For example, problems arise when, in an effort to save energy, ventilation systems are not used to bring in adequate amounts of outdoor air. Inadequate ventilation also occurs if the air supply and return vents within each room are blocked or placed in such a way that outdoor air does not actually reach the breathing zone of building occupants. Improperly located outdoor air intake vents can also bring in air contaminated with automobile and truck exhaust, boiler emissions, fumes from dumpsters, or air vented from restrooms. Finally, ventilation systems can be a source of in door pollution themselves by spreading biological contaminants that have multiplied in cooling towers, humidifiers, dehumidifiers, air conditioners, or the inside surfaces of ventilation duct work.

Use of the Building

Indoor air pollutants can be circulated from portions of the building used for specialized purposes, such as restaurants, print shops, and dry-cleaning stores, into offices in the same building. Carbon monoxide and other components of automobile exhaust can be drawn from underground parking garages through stairwells and elevator shafts into office spaces.

In addition, buildings originally designed for one purpose may end up being converted to use as office space. If not properly modified during building renovations, the room partitions and ventilation system can contribute to indoor air quality problems by restricting air recirculation or by providing an inadequate supply of outdoor air.

What to Do if You Suspect a Problem

If you or others at your office are experiencing health or comfort problems that you suspect may be caused by indoor air pollution, you can do the following:

- Talk with other workers, your supervisor, and union representatives to see if the problems are being experienced by others and urge that a record of reported health complaints be kept by management, if one has not already been established.
- Talk with your own physician and report your problems to the company physician, nurse, or health and safety officer.
- Call your state or local health department or air pollution control agency to talk over the symptoms and possible causes.
- Encourage building management to obtain a copy of *Building Air Quality: A Guide for Building Owners and Facility Managers*. Building Air Quality (BAQ) is simply written, yet provides comprehensive information for identifying, correcting, and preventing indoor air quality problems. BAQ also provides supporting information such as when and how to select outside technical assistance, how to communicate with others regarding indoor air issues, and where to find additional sources of information. To obtain the loose leaf fomat version of the Building Air Quality, complete with appendices, an index, and a full set of useful forms, and the newly released, Building Air Quality Action Plan, order GPO Stock # 055-000-00602-4, for $28, contact the: Superintendent of Documents, U.S. Government Printing Office (GPO), P.O. Box 371954, Pittsburgh, PA 15250-7954, or call (202) 512-1800, fax (202) 512-2250.
- Obtain a copy of "An Office Building Occupant's Guide to Indoor Air Quality," EPA-402-K-97-003, October 1997 from IAQ INFO at 1-800-438-4318.
- Frequently, indoor air quality problems in large commercial buildings cannot be effectively identified or remedied without a comprehensive building investigation. These investigations may start with written questionnaires and telephone consultations in which building investigators assess the history of occupant symptoms and building operation procedures. In some cases, these inquiries may quickly uncover the problem and on-site visits are unnecessary.
- More often, however, investigators will need to come to the building to conduct personal interviews with occupants, to look for possible sources of the problems, and to inspect the design and operation of the ventilation system and other building features. Because taking measurements of pollutants at the very low levels often found in office buildings is expensive and may not yield information readily useful in identifying problem sources, investigators may not take many measurements. The process of solving indoor air quality problems that result in health and comfort complaints can be a slow one, involving several trial solutions before successful remedial actions are identified.
- If a professional company is hired to conduct a building investigation, select a company on the basis of its experience in identifying and solving indoor air quality problems in non-industrial buildings.
- Work with others to establish a smoking policy that eliminates involuntary nonsmoker exposure to environmental tobacco smoke.
- Call the National Institute for Occupational Safety and Health (NIOSH) for information on obtaining a health hazard evaluation of your office (800-35NIOSH), or contact the Occupational Safety and Health Administration, (202) 219-8151.

Reference Guide to Major Indoor Air Pollutants in the Home

The pollutants listed in this guide have been shown to cause the health effects mentioned. However, it is not necessarily true that the effects noted occur at the pollutant concentration levels typically found in the home. In many cases, our understanding of the pollutants and their health effects is too limited to determine the levels at which the listed effects could occur.

RADON (Rn)

Sources: Earth and rock beneath home; well water; building materials.
Health Effects: 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.
Levels in Homes: Based on a national residential radon survey completed in 1991, the average indoor radon level is 1.3 picocuries per liter (pCi/L). The average outdoor level is about 0.4 pCi/L.

Steps to Reduce Exposure:

- Test your home for radon, it's easy and inexpensive.
- Fix your home if your radon level is 4 picocuries per liter (pCi/L) or higher.
- Radon levels less than 4 pCi/L still pose a risk, and in many cases may be reduced.
- If you want more information on radon, contact your state radon office, or call 800-SOS-RADON.

ENVIRONMENTAL TOBACCO SMOKE (ETS)

Source: Cigarette, pipe, and cigar smoking.
Health Effects: Eye, nose, and throat irritation; headaches; lung cancer; may contribute to heart disease. Specifically for children, increased risk of lower respiratory tract infections, such as bronchitis and pneumonia, and ear infections; build-up of fluid in the middle ear; increased severity and frequency of asthma episodes; decreased lung function.
Levels in Homes: Particle levels in homes without smokers or other strong particle sources are the same as, or lower than, those outdoors. Homes with one or more smokers may have particle levels several times higher than outdoor levels.
Steps to Reduce Exposure:

- Do not smoke in your home or permit others to do so.
- Do not smoke if children are present, particularly infants and toddlers.
- If smoking indoors cannot be avoided, increase ventilation in the area where smoking takes place. Open windows or use exhaust fans.

BIOLOGICALS

Sources: Wet or moist walls, ceilings, carpets, and furniture; poorly maintained humidifiers, dehumidifiers, and air conditioners; bedding; household pets.
Health Effects: Eye, nose, and throat irritation; shortness of breath; dizziness; lethargy; fever; digestive problems. Can cause asthma; humidifier fever; influenza and other infectious diseases.
Levels in Homes: Indoor levels of pollen and fungi are lower than outdoor levels (except where indoor sources of fungi are present). Indoor levels of dust mites are higher than outdoor levels.
Steps to Reduce Exposure:

- Install and use fans vented to outdoors in kitchens and bathrooms.
- Vent clothes dryers to outdoors.
- Clean cool mist and ultrasonic humidifiers in accordance with manufacturer's instructions and refill with clean water daily.
- Empty water trays in air conditioners, dehumidifiers, and refrigerators frequently.
- Clean and dry or remove water-damaged carpets.
- Use basements as living areas only if they are leak-proof and have adequate ventilation. Use dehumidifiers, if necessary, to maintain humidity between 30-50 percent.

CARBON MONOXIDE (CO)

Sources: Unvented kerosene and gas space heaters; leaking chimneys and furnaces; back-drafting from furnaces, gas water heaters, woodstoves, 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 woodstoves that are certified to meet EPA emission standards. Make certain that doors on all woodstoves 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.

NITROGEN DIOXIDE (NO_2)

Sources: Kerosene heaters, unvented gas stoves and heaters. Environmental tobacco smoke. Health Effects: Eye, nose, and throat irritation. May cause impaired lung function and increased respiratory infections in young children.
Levels in Homes: Average level in homes without combustion appliances is about half that of outdoors. In homes with gas stoves, kerosene heaters, or unvented gas space heaters, indoor levels often exceed outdoor levels.
Steps to Reduce Exposure: See steps under carbon monoxide.

ORGANIC GASES

Sources: Household products including: paints, paint strippers, and other solvents; wood preservatives; aerosol sprays; cleansers and disinfectants; moth repellents and air fresheners; stored fuels and automotive products; hobby supplies; dry-cleaned clothing.
Health Effects: Eye, nose, and throat irritation; headaches, loss of coordination, nausea; damage to liver, kidney, and central nervous system. Some organics can cause cancer in animals; some are suspected or known to cause cancer in humans.
Levels in Homes: Studies have found that levels of several organics average 2 to 5 times higher indoors than outdoors. During and for several hours immediately after certain activities, such as paint stripping, levels may be 1,000 times background outdoor levels.
Steps to Reduce Exposure:

- Use household products according to manufacturer's directions.
- Make sure you provide plenty of fresh air when using these products.
- Throw away unused or little-used containers safely; buy in quantities that you will use soon.
- Keep out of reach of children and pets.
- Never mix household care products unless directed on the label.

RESPIRABLE PARTICLES

Sources: Fireplaces, woodstoves, and kerosene heaters. Environmental tobacco smoke.
Health Effects: Eye, nose, and throat irritation; respiratory infections and bronchitis; lung cancer. (Effects attributable to environmental tobacco smoke are listed elsewhere.)
Levels in Homes: Particle levels in homes without smoking or other strong particle sources are the same as, or lower than, outdoor levels.
Steps to Reduce Exposure:

- Vent all furnaces to outdoors; keep doors to rest of house open when using unvented space heaters.
- Choose properly sized woodstoves, certified to meet EPA emission standards; make certain that doors on all woodstoves fit tightly.
- Have a trained professional inspect, clean, and tune-up central heating system (furnace, flues, and chimneys) annually. Repair any leaks promptly.
- Change filters on central heating and cooling systems and air cleaners according to manufacturer's directions.

FORMALDEHYDE

Sources: Pressed wood products (hardwood plywood wall paneling, particleboard, fiberboard) and furniture made with these pressed wood products. Urea-formaldehyde foam insulation (UFFI). Combustion sources and environmental tobacco smoke. Durable press drapes, other textiles, and glues.
Health Effects: Eye, nose, and throat irritation; wheezing and coughing; fatigue; skin rash; severe allergic reactions. May cause cancer. May also cause other effects listed under "organic gases."
Levels in Homes: Average concentrations in older homes without UFFI are generally well below 0.1 (ppm). In homes with significant amounts of new pressed wood products, levels can be greater than 0.3 ppm.
Steps to Reduce Exposure:

- Use "exterior-grade" pressed wood products (lower-emitting because they contain phenol resins, not urea resins).
- Use air conditioning and dehumidifiers to maintain moderate temperature and reduce humidity levels.
- Increase ventilation, particularly after bringing new sources of formaldehyde into the home.

PESTICIDES

Sources: Products used to kill household pests (insecticides, termiticides, and disinfectants). Also, products used on lawns and gardens that drift or are tracked inside the house.
Health Effects: Irritation to eye, nose, and throat; damage to central nervous system and kidney; increased risk of cancer.
Levels in Homes: Preliminary research shows widespread presence of pesticide residues in homes.
Steps to Reduce Exposure:

- Use strictly according to manufacturer's directions.
- Mix or dilute outdoors.
- Apply only in recommended quantities.
- Increase ventilation when using indoors. Take plants or pets outdoors when applying pesticides to them.
- Use non-chemical methods of pest control where possible.
- If you use a pest control company, select it carefully.
- Do not store unneeded pesticides inside home; dispose of unwanted containers safely.
- Store clothes with moth repellents in separately ventilated areas, if possible.
- Keep indoor spaces clean, dry, and well ventilated to avoid pest and odor problems.

ASBESTOS

Sources: Deteriorating, damaged, or disturbed insulation, fireproofing, acoustical materials, and floor tiles.
Health Effects: No immediate symptoms, but long-term risk of chest and abdominal cancers and lung diseases. Smokers are at higher risk of developing asbestos-induced lung cancer.
Levels in Homes: Elevated levels can occur in homes where asbestos-containing materials are damaged or disturbed.
Steps to Reduce Exposure:

- It is best to leave undamaged asbestos material alone if it is not likely to be disturbed.
- Use trained and qualified contractors for control measures that may disturb asbestos and for cleanup.
- Follow proper procedures in replacing woodstove door gaskets that may contain asbestos.

LEAD

Sources: Lead-based paint, contaminated soil, dust, and drinking water.
Health Effects: Lead affects practically all systems within the body. Lead at high levels (lead levels at or above 80 micrograms per deciliter (80 ug/dl) of blood) can cause convulsions, coma, and even death. Lower levels of lead can cause adverse health effects on the central nervous system, kidney, and blood cells. Blood lead levels as low as 10 ug/dl can impair mental and physical development.
Steps to Reduce Exposure:

- Keep areas where children play as dust-free and clean as possible.
- Leave lead-based paint undisturbed if it is in good condition; do not sand or burn off paint that may contain lead.
- Do not remove lead paint yourself.
- Do not bring lead dust into the home.
- If your work or hobby involves lead, change clothes and use doormats before entering your home.
- Eat a balanced diet, rich in calcium and iron.

Where to Go for Additional Information on Indoor Air Quality

DISCLAIMER: Links to other Federal Agencies on this page are pointers to other hosts and locations in the Internet. The information on this is provided here as a service. The U.S. Environmental Protection Agency does not endorse, approve or otherwise support these other Federal sites.

Federal Information Sources for Indoor Air Quality

Federal agencies with indoor air quality information may be contacted as follows:

U. S. Environmental Protection Agency (U.S. EPA)

INDOOR AIR QUALITY - Information Clearinghouse (IAQ INFO)
P.O. Box 37133
Washington, DC 20013-7133
(800) 438-4318; (703) 356-4020
(fax) 703-356-5386 or e-mail: iaqinfo@aol.com
Operates Monday to Friday from 9a.m. to 5p.m. Eastern Standard Time (EST). Distributes EPA publications, answers questions on the phone, and makes referrals to other nonprofit and governmental organizations.

NATIONAL RADON HOTLINES
(800) SOS-RADON
[(800) 767-7236]
Information recording operates 24 hours a day.

NATIONAL LEAD INFORMATION CENTER
(800) LEAD-FYI
[(800) 532-3394]
Operates 24 hours a day, seven days a week. Callers may order an information package. To speak to an information specialist, call (800) 424-5323. Operates Monday to Friday from 8:30a.m. to 5p.m. EST.

NATIONAL PESTICIDES TELECOMMUNICATIONS NETWORK
National toll-free number: **(800) 858-PEST**
[In Oregon - (800) 858-7378]
Operates Monday to Friday from 6:30a.m. to 4:30p.m. Pacific Time. Provides information about pesticides to the general public and the medical, veterinary, and professional communities. Medical and government personnel may call 800-858-7377.

RCRA/SUPERFUND HOTLINE
National toll-free number: **(800) 424-9346**
In Washington, DC area: (703) 412-9810
Operates Monday to Friday from 8:30a.m. to 7:30p.m. EST. Provides information on regulations under both the Resources Conservation and Recovery Act (including solid and hazardous waste issues) and the Superfund law.

SAFE DRINKING WATER HOTLINE
(800) 426-4791
Operates Monday to Friday from 8:30a.m. to 5p.m. EST. Provides information on regulations under the Safe Drinking Water Act, lead and radon in drinking water, filter information, and a list of state drinking water offices.

TSCA ASSISTANCE INFORMATION SERVICE
(202) 554-1404
Operates Monday to Friday from 8:30a.m. to 5p.m. EST. Provides information on regulations under the Toxic Substances Control Act and on EPA's asbestos program.

U.S. Consumer Product Safety Commission (CPSC) [http://www.cpsc.gov/]

Washington, DC 20207-0001
Product Safety Hotline: (800) 638-CPSC
Teletypewriter for the hearing impaired (outside Maryland): (800) 638-8270;
Maryland only: (800) 492-8104.
Recorded information is available 24 hours a day when calling from a touch-tone phone. Operators are on duty Monday to Friday from 10:30 to 4 EST to take complaints about unsafe consumer products.

U.S. Department of Housing and Urban Development [http://www.hud.gov/]

Office of Energy and the Environment, Washington, DC 20410
HUD USER National toll-free number: (800) 245-2691
In Washington, DC area: (301) 251-5154

U.S. Department of Energy [http://www.doe.gov/]

Office of Conservation and Renewable Energy
1000 Independence Ave., SW, Washington, DC 20585

Conservation and Renewable Energy Inquiry and Referral Service (CAREIRS)
PO Box 3048, Merrifield, VA 22116
Operates Monday to Friday from 9 to 5 EST. Provides consumer information on conservation and renewable energy in residences.

U.S. Public Health Service

Division of Federal Occupational Health
Office of Environmental Hygiene, Region III, Room 1310
3535 Market St., Philadelphia, PA 19104
(215) 596-1888; fax: 215-596-5024
Provides indoor air quality consultative services to federal agency managers.

Centers for Disease Control and Prevention [http://www.cdc.gov]

Lead Poisoning Prevention Branch
Centers for Disease Control and Prevention
4770 Buford Highway, NE (F-42)
Atlanta, GA 30341-3724
(800) 488-7330

Office on Smoking and Health
Centers for Disease Control and Prevention
4770 Buford Highway, NE (K-50)
Atlanta, GA 30341-3724
(404) 488-5701

Occupational Safety and Health Administration (OSHA) [http://www.osha.gov/]
Office of Information and Consumer Affairs
Room N-3647, 200 Constitution Avenue, NW
Washington, DC 20210
(202) 219-8151

State and Local Organizations

Your questions or concerns about indoor air problems can frequently be answered by the government agencies in your state or local government. Responsibilities for indoor air quality issues are usually divided among many different agencies. Calling or writing the agencies responsible for health or air quality control is the best way to start getting information from your state or local government. To obtain state agency contacts, write or call EPA's IAQ Information Clearinghouse, (800) 438-4318, (703) 356-4020 in the Washington, D.C. area.

Other Organizations

The following organizations have information specifically discussed in this booklet. Call the IAQ Information Clearinghouse at (800) 438-4318 for the names of a variety of organizations that have more information on specific and general indoor air quality issues.

American Association of Poison Control Centers (AAPCC)
3800 Reservoir Road, NW
Washington, DC 20007

Association of Home Appliance Manufacturers (AHAM)
1111 19th Street, NW
Suite 402
Washington, DC 20036
(202) 872-5955

AHAM also provides information on air cleaners on their AHAM-certified Clean Air Delivery Rate site at www.cadr.org

American Society of Heating, Refrigerating, and Air-Conditioning (ASHRAE)
1791 Tullie Circle NE
Atlanta, GA 30329

World Health Organization (WHO)
Publications Center
49 Sheridan Avenue
Albany, NY 12210

Your Local American Lung Association (ALA)
National ALA Headquarters
1740 Broadway
New York, NY 10019
(800) LUNG-USA

Glossary of Terms

ACID AEROSOL: Acidic liquid or solid particles that are small enough to become airborne. High concentrations of acid aerosols can be irritating to the lungs and have been associated with some respiratory diseases, such as asthma.
ANIMAL DANDER: Tiny scales of animal skin.
ALLERGEN: A substance capable of causing an allergic reaction because of an individual's sensitivity to that substance.
ALLERGIC RHINITIS : Inflammation of the mucous membranes in the nose that is caused by an allergic reaction.
BUILDING-RELATED ILLNESS: A discrete, identifiable disease or illness that can be traced to a specific pollutant or source within a building. (Contrast with "Sick building syndrome").
CHEMICAL SENSITIZATION: Evidence suggests that some people may develop health problems characterized by effects such as dizziness, eye and throat irritation, chest tightness, and nasal congestion that appear whenever they are exposed to certain chemicals. People may react to even trace amounts of chemicals to which they have become "sensitized."
ENVIRONMENTAL TOBACCO SMOKE (ETS): Mixture of smoke from the burning end of a cigarette, pipe, or cigar and smoke exhaled by the smoker (also secondhand smoke or passive smoking).
FUNGI: Any of a group of parasitic lower plants that lack chlorophyll, including molds and mildews.
HUMIDIFIER FEVER: A respiratory illness caused by exposure to toxins from microorganisms found in wet or moist areas in humidifiers and air conditioners. Also called air conditioner or ventilation fever.
HYPERSENSITIVITY PNEUMONITIS: A group of respiratory diseases that cause inflammation of the lung (specifically granulomatous cells). Most forms of hypersensitivity pneumonitis are caused by the inhalation of organic dusts, including molds.
ORGANIC COMPOUNDS: Chemicals that contain carbon. Volatile organic compounds vaporize at room temperature and pressure. They are found in many indoor sources, including many common household products and building materials.
PICOCURIE (pCi): A unit for measuring radioactivity, often expressed as picocuries per liter (pCi/L) of air.
PRESSED WOOD PRODUCTS: A group of materials used in building and furniture construction that are made from wood veneers, particles, or fibers bonded together with an adhesive under heat and pressure.
RADON (Rn) AND RADON DECAY PRODUCTS: Radon is a radioactive gas formed in the decay of uranium. The radon decay products (also called radon daughters or progeny) can be breathed into the lung where they continue to release radiation as they further decay.
SICK BUILDING SYNDROME: Term that refers to a set of symptoms that affect some number of building occupants during the time they spend in the building and diminish or go away during periods when they leave the building. Cannot be traced to specific pollutants or sources within the building. (Contrast with "Building related illness").
VENTILATION RATE: The rate at which indoor air enters and leaves a building. Expressed in one of two ways: the number of changes of outdoor air per unit of time (air changes per hour, or "ach") or the rate at which a volume of outdoor air enters per unit of time (cubic feet per minute, or "cfm").

How Do I Order a Copy of This Booklet?

This document is in the public domain. It may be reproduced in part or in whole by an individual or organization without permission. Single copies of this booklet are available from:

EPA's **IAQ Information Clearinghouse (IAQINFO)**
(800) 438-4318; (703) 356-4020
P.O. Box 37133,
Washington, DC, 20013-7133
iaqinfo@aol.com

or, you can order these publications directly via EPA's **National Service Center for Environmental Publications (NSCEP)** (http://www.epa.gov/ncepihom/). website. Your publication requests can also be mailed, called or faxed directly to:

U.S. Environmental Protection Agency
National Center for Environmental Publications (NSCEP)
P.O. Box 42419
Cincinnati, OH 42419
1-800-490-9198/(513) 489-8695 (fax)

Please use the EPA Document Number (# 402-K-93-007, April 1995), when ordering from **NSCEP** or from **IAQ INFO**.
Multiple copies may be purchased from the Government Printing Office. Call (202) 783-3238 or send check or money order for $44.00 (25 per package) to: Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA, 15250-7954. Include the stock number 055-000-00441-2.