



### **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 \(RRNC\)](#) site and read "Building Radon Out: A Step-by-Step Guide on How to Build Radon-Resistant Homes" EPA 402-K-01-002, April 2001 - [www.epa.gov/radon/pubs](http://www.epa.gov/radon/pubs)

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.

- A. Provide proper drainage and seal foundations in new construction.
- B. Air that enters the home through the foundation can contain more moisture than is generated from all occupant activities.
- C. Become familiar with mechanical ventilation systems and consider installing one.
- D. 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).
- E. Ensure that combustion appliances, including furnaces, fireplaces, woodstoves, and heaters, are properly vented and receive enough supply air.
- F. 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.

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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 indoor pollution themselves by spreading biological contaminants that have multiplied in cooling towers, humidifiers, dehumidifiers, air conditioners, or the inside surfaces of ventilation duct work.

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## **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 (see our Where You Live pages at [www.epa.gov/iaq/wherelive.html](http://www.epa.gov/iaq/wherelive.html)) or air pollution control agency to talk over the symptoms and possible causes.

You can encourage building management to follow guidance in EPA's [\*IAQ Building Education and Assessment Model \(I-BEAM\)\*](#). I-BEAM updates and expands EPA's existing Building Air Quality guidance and is designed to be comprehensive state-of-the-art guidance for managing IAQ in commercial buildings. This guidance was designed to be used by building professionals and others interested in indoor air quality in commercial buildings. I-BEAM contains text, animation/visual, and interactive/calculation components that can be used to perform a number of diverse tasks. You can also encourage building management to follow guidance in EPA and NIOSH's [\*Building Air Quality: A Guide for Building Owners and Facility Managers\*](#) (The BAQ is available here as PDF files which can be downloaded and viewed individually or as a single file with all of the PDF files).

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.

### **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.

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