Is Air Quality a Problem in My Home?

The subject of indoor air pollution has received a great deal of attention in recent years. Although most of the concern originally focused on the workplace, more people are looking for answers to health and comfort problems occurring in their homes.

The American Industrial Hygiene Association (AIHA) has produced this fact sheet to help homeowners, landlords, and tenants of residential dwellings to recognize and respond to indoor air quality problems. The information presented herein applies specifically to residential dwellings whether owned or rented, but in the case of rental housing, only the building owner or manager can remedy the problem. You can prevent or resolve many problems with common sense and a little knowledge of potential air pollutant sources and building systems. This document cannot address all of the potential problems in the indoor environment. You should also be aware that indoor air quality problems may be due to more than one cause and those health problems may not necessarily be caused by the indoor environment. For these reasons, industrial hygienists and other environmental health scientists will continue to research these complex issues.

What Is Indoor Air Quality?

Americans spend the vast majority of their time indoors, especially in urban environments. As such, indoor air quality must be properly maintained to provide a safe and healthy living environment that minimizes discomfort and potential disease. It is sometimes easier to recognize “poor” indoor air quality than it is to define “good” indoor air quality (IAQ). A few examples that may suggest poor indoor air quality include:

- Stale (“stuffy”) air
- Lingering disagreeable odors
- Occupants with eye, nose or throat irritation
- Mold or bacterial problems
- Relative humidity levels below 30% or over 60%
- Tobacco smoke
- Excessive dust or allergens, such as animal dander

Good indoor air quality should not cause discomfort or health problems. You can be affected by many factors in the indoor environment to varying degrees. Your health and comfort can also be affected by factors other than air contaminants, such as food, drinking water, furniture and bedding, air temperature, humidity, lighting, stress, etc.

Other potential problems are not as obvious as those listed above and can only be detected with scientific testing equipment. These include:

- Carbon monoxide and other contaminants from appliances, fireplaces, vehicles
- Naturally-occurring radon gas
- Pesticides (insecticides, herbicides, fungicides, and rodenticides)
- Asbestos from deteriorated building materials
- Dust containing lead and other heavy metals

Can Poor Indoor Air Quality Cause Serious Health Problems?

Many indoor air quality problems only cause discomfort or irritation and do not result in serious health problems. Not everyone reacts in the same way to IAQ problems. Some people who experience symptoms find that they feel much better soon after leaving the area. Below are some examples of problems that you should be aware of because they can result in serious illness or death.

Carbon monoxide - Carbon monoxide and other combustion byproducts can build up to hazardous or fatal levels in homes where insufficient outside air is provided to appliances that burn natural gas, propane, fuel oil, or wood. This may include furnaces, space heaters, fireplaces, stoves, water heaters, and clothing
dryers. An adequate quantity of outside air should be provided to the furnace area to make up for the air that goes up the exhaust flue. Otherwise, combustion gases containing high amounts of carbon monoxide can “back-draft” down the flue. Combustion appliances should be inspected and cleaned periodically for proper combustion and venting. This is an instance of indoor air problems that can be created by “over tightening” a building for energy saving. Some outside air must be let into your home to replace exhausted air. Refer to the AIHA fact sheet “Carbon Monoxide — The Silent, Cold Weather Killer,” listed at the end of this document.

**Radon gas** - Radon is one of the leading causes of lung cancer and is estimated to cause about 21,000 lung cancer deaths per year. Radon is a radioactive gas that comes from the natural decay of uranium that is found in nearly all soils. Radon enters the home through cracks in the foundation, porous concrete blocks, sump openings, unfinished basement floors, and, in some areas, untreated well water. The United States Environmental Protection Agency (EPA) recommends that you have your home tested to see if radon reduction methods are needed. If a radon reduction device is needed, it should be installed by a professional so that it will not cause back-drafting of your furnace or other appliances. Refer to the Environmental Protection Agency’s (EPA) “A Citizens Guide to Radon” listed at the end of this document.

**Environmental Tobacco Smoke** - Cigarette smoke, which contains carbon monoxide, formaldehyde and thousands of other chemicals, can pose a serious problem in the home environment. Recent studies have shown that exposure to second-hand tobacco smoke may result in inner ear infections, asthma, and lung cancer in non-smokers. The EPA has listed environmental tobacco smoke as a confirmed cancer-causing agent. Indoor air quality can be greatly improved, and health risks significantly reduced, by preventing indoor smoking. It should be noted that the increased use of electronic cigarettes indoors may contribute new sources of indoor air contaminants including nicotine, plus flavor and fragrance additives.

**Asbestos** – Asbestos comprises a set of six naturally occurring silicate minerals that when inhaled over a period of time can cause lung cancer, mesothelioma, and asbestosis. Asbestos was widely used in a variety of products and building materials dating back over 4,000 years ago but was most commonly used from the late 19th century through the 1970’s. New building products are much less likely to contain asbestos but it can still be found in some products sold today plus many older homes still contain asbestos-containing materials such as: pipe insulation, vinyl flooring materials, cementitious shingles and siding, wall and ceiling plasters, decorative wall and ceiling textures, roofing materials, etc. Homeowners should have their houses checked for asbestos by a professional prior to conducting renovations. Older homes may also have insulation that consists of a light-weight material called vermiculite, which is often contaminated with asbestos fibers. The EPA estimates that as many as 35 million homes may have this material in the attic or in wall cavities. Refer to EPA’s Asbestos web page for additional information on asbestos, see link at end of this document. Refer also to the EPA document titled “Protect your Family from asbestos-contaminated vermiculite insulation”, see link at end of this document.

**Legionnaires’ disease** – Legionnaires’ disease is a potentially fatal pneumonia caused most commonly by *Legionella pneumophila* bacteria. The first recognized case of Legionnaires disease occurred in 1975 but the number of cases reported has increased in recent years and it is currently estimated that there are up to 18,000 cases of Legionnaires’ disease reported each year in the United States. *Legionella pneumophila* bacteria are ubiquitous in the aquatic environment and they can often be found in air conditioning systems, cooling towers, humidifiers, whirlpool spas, domestic water plumbing systems, misting systems, indoor fountains, etc. Growth of Legionella bacteria can be controlled by proper maintenance and cleaning of the above sources. Refer to the Centers for Disease Control and Prevention (CDC) web page for additional information, see link at end of this document.

**Chemicals in the Home**

Inventory all the commercial chemical products or chemically-treated items in your home. You may be surprised to know how many common products contain toxic or irritating chemicals that can affect indoor air. For example, freshly dry-cleaned clothing may give off solvent vapors. Air out your freshly dry-cleaned clothes in an unoccupied room.

Petroleum solvent-based paints release solvent vapors during use and during brush cleaning. Use water-based paints whenever possible, but make sure they do not contain mercury. Use paints that are low or zero-emitting in volatile organic compounds (VOCs). Do not use paint stripping chemicals that contain methylene chloride, which is a potential cancer-causing agent.

Never store gasoline in the home. It is highly flammable and may release benzene (which may cause cancer) and other hydrocarbon vapors. Never use gasoline as a cleaning solvent!

Pesticides should only be used when absolutely necessary. Even moth balls give off potentially hazardous
substances in small amounts. Pesticides should be stored in the garage or away from inhabited areas. Hire a licensed pesticide applicator if you have a major pest problem. Check the pest control company's references, ask to see Material Safety Data Sheets for the products it uses and review the company's procedures to ensure that they address your concerns.

Be careful when disposing of unneeded chemicals. Many localities have household hazardous material disposal sites to drop off old paints, solvents, pesticides, and other chemicals.

**What You Can Do To Control Indoor Chemical Pollutants**

A quick and cost-effective way to improve the quality of your air is by reducing your use of chemical materials indoors. Some basic rules for maintaining good indoor air quality are:

- Find out what chemicals you have and reduce unnecessary use of chemicals
- Do not bring home chemicals designed for use in the workplace
- Open your windows and/or use fans when using products that give off vapors
- Use household chemicals outside, if possible
- Provide adequate ventilation when removing paints or varnish using solvents or heat guns
- Have your home tested for asbestos and lead in paint prior to starting any renovations
- Do not disturb or remove asbestos-containing materials yourself; hire a licensed contractor
- Never sand or use a heat gun on lead-containing paints indoors
- Store toxic chemicals away from occupied areas and air conditioner closets
- Use non-chemical methods of pest control whenever possible.
- Properly dispose of any chemicals you do not need
- Do not use or limit use of air freshener devices and sprays

**How Can Building Materials and Furnishings Affect Indoor Air?**

A number of materials used in constructing, furnishing, and insulating a home contribute small, but sometimes noticeable amounts of dusts or irritating vapors.

**Formaldehyde**

Plywood, particle-board, and other pressed wood products are often held together with formaldehyde-based resins. Formaldehyde can cause eye, nose and throat irritation, and several federal agencies list it as a cancer-causing agent. Some people can become sensitized to formaldehyde and experience severe skin or respiratory symptoms. Federal standards require formaldehyde emission testing and labeling. Look for this labeling when you buy wood products.

**Insulation**

Insulation materials can affect indoor air quality. Urea-Formaldehyde Foam Insulation (UFFI) was used in the walls of many homes in the 1970s. UFFI is very rarely used today. This type of insulation resulted in significant levels of formaldehyde in some homes. Formaldehyde vapors from this source decrease with time, but sensitized people may react to low levels or decomposed UFFI dust. Exposed fiberglass insulation inside air ducts can release irritating fibers if it breaks down with age or water damage. Try to find fiberglass insulation with a plastic outer lining. Any kind of insulation can be a problem if it gets wet, since it can harbor molds and mildew.

**Carpeting, Furnishings, and Housekeeping**

Old carpets and some fabrics can harbor molds, dust mites (microscopic organisms that may cause allergic reactions), allergenic animal hairs or dusts, asbestos fibers, and lead-containing dust. Dust mites typically live in areas where you sleep or sit for long periods of time. Dust mites and molds thrive when indoor humidity conditions exceed 60%. Proper housekeeping is essential to minimize the proliferation of dust and microorganisms indoors. Thorough vacuuming should be performed regularly at least once a week. Because the air filters on most household vacuum cleaners are not very efficient, microscopic particles can get into the air. A central vacuum system that discharges the filtered air outside the building or a portable vacuum cleaner equipped with high efficiency particulate air (HEPA) filters should be used. Steam cleaning carpets and fabric upholstered furniture should be performed at least annually to reduce amounts of dirt and debris. If steam cleaning is performed, fans should be used to dry the carpet out within 24 to 48 hours or
else the wet carpet may support the growth of microorganisms. Do not shampoo carpets as it causes the carpeting to become saturated with moisture.

New carpets, carpet backings and adhesives may release volatile organic compounds and other irritating vapors. Here are a few simple suggestions for preserving good indoor air quality:

- Contact the manufacturer and ask for any available health testing information
- Have the dealer unroll and air out the carpet before installation
- Try using nails instead of adhesives, if possible
- Provide plenty of fresh air to the space during installation and for a few days after installation

**What about Fungi and Mold?**

There are thousands of types of fungi (i.e. molds) and all of them are capable of causing allergic symptoms in sensitized persons. Many people are allergic to fungi and some types can cause disease or release toxins (e.g. penicillin). Fungi are most likely to be found in damp areas of your home or with high humidity (>60%) such as areas with improper drainage, porous foundation materials, improperly maintained humidifiers, dehumidifiers, or air conditioners. Leaks from roof systems, plumbing, and windows are also common causes of mold growth. A single flooding event can create a significant mold problem unless it is immediately dried out within 24 to 48 hours. To avoid these problems do not allow water to form pools or wet spots inside or immediately outside your home. Thoroughly clean and disinfect or remove surfaces where molds have grown in the past. Humidifiers with a water reservoir can cause mold or bacterial contamination of indoor air, and should be cleaned thoroughly at least once a week. Empty and clean the water collection pans of refrigerators, dehumidifiers, and air conditioners frequently. Reduce the moisture that leads to mold growth by sealing and patching walls and floors either at the source and/or by using a dehumidifier.

Testing for airborne mold spores is not usually necessary in order to identify a mold problem. Most mold problems can be identified by conducting a visual inspection; testing for moisture content is also helpful to identify areas that are prone to mold growth. If you can see mold then you have a mold problem, although many times the mold growth is hidden inside wall or ceiling cavities and the full extent of damage may not be apparent until mold remediation is performed. If you suspect you have a mold problem you should consult a professional mold inspector. If small amounts (<10 square feet) of mold growth exists inside your home, it will be necessary to physically remove the mold from the surface it is growing on. Porous surfaces such as glass, metal, plastic, ceramic tiles, etc. can be cleaned using ordinary soap and water. Non-porous surfaces such as gypsum wallboard, carpeting, insulation, etc. cannot be cleaned and must be physically removed and discarded following industry guidelines for mold remediation and wearing appropriate protective equipment. Do not attempt to use bleach to kill mold. If the amount of mold is greater than 10 square feet, a professional mold contractor should be used.

If your home suffers flood damage, clean and sanitize water-damaged furnishings and construction materials as soon as possible. Porous surfaces, such as carpets or fabrics, may not be as easy to clean as smooth or painted surfaces, such as linoleum. Discard anything you cannot clean and dry, since even dry spores can continue to cause allergic symptoms. Refer to the AIHA document “Facts about Mold”, see link at end of this document.

**What if You Cannot Control the Source?**

Ventilation and air-cleaning devices can reduce exposure to air pollutants that cannot be eliminated by source control:

- To reduce carbon monoxide build-up and improve efficiency, provide outside air to the furnace
- For new construction, consider air-to-air heat exchangers to save energy while bringing in more outside air
- Use exhaust fans to vent kitchen and bathroom odors and moisture to the outside
- Use higher efficiency furnace or air conditioner air filters and change filters frequently
- Consult EPA publications and choose air-cleaning devices carefully

A wide variety of “air cleaners” are now on the market. Before investing in such a device, carefully evaluate the manufacturer's claims and the limitations of the device. Many air cleaners work well controlling dust particles but do not control odors or vapors. Pay particular attention to the frequency and cost of replacement filters and ease of cleaning. A poorly-maintained air cleaner can frequently make the air quality worse rather than better.
Testing Your Indoor Air Quality

No single air testing method is available to figure out the total quality of your home air. Air testing is often not worthwhile unless you know exactly what to test for. Discomfort or unusual odors are the best judge of indoor air quality in homes. Some pollutants, such as radon and carbon monoxide, are odorless, colorless, and tasteless and can only be evaluated by testing. Carbon monoxide and radon test kits may be available through your local American Lung Association or your local hardware store.

If you have concerns about combustion product back-drafting, some contractors can help you test whether back-drafting is likely in your home. Carbon monoxide detecting alarms are also available for continuous monitoring.

Other air monitoring devices are available for formaldehyde and specific organic compounds. Use of some sampling devices requires scientific training and analysis by a qualified laboratory. Your local or state department of health can refer you to local sources for sampling device purchase and analysis.

If you are unable to resolve your IAQ problem by yourself, contact a reputable contractor or a professional industrial hygiene consultant for additional support. Make sure to check references and experience. Refer to the “Guidelines for Selecting an Indoor Air Quality Consultant” fact sheet below.

Beware of Scams

The field of indoor air quality investigation and remediation is relatively new. As a result, many opportunists have emerged to profit from your lack of knowledge and your desire for a healthy environment. An example is the ozone generator, which some companies promote as a “cure” for indoor formaldehyde and odors. Although the manufacturers claim that the units neutralize odors and chemical pollutants, they may produce ozone at levels above what is considered safe.

For Additional Information

- Carbon Monoxide–The Silent, Cold Weather Killer
- Facts About Mold
- Guidelines for Selecting an Indoor Air Quality Consultant
- Is Lead a Problem in My Home?
- Improving Indoor Air Quality at Work (Add url when update is complete)
- EPA - A Citizens Guide to Radon
- EPA Asbestos Page
- EPA - Protect your family from asbestos-contaminated vermiculite insulation
- CDC - Legionella home page
- EPA - Guide to Air Cleaners in the Home