



Residential Housing

HOUSING -- HOME ECONOMICS
240 Poole Agricultural Center
Clemson, S.C. 29634-0315
(803)656-3305 FAX (803) 656-5723

HOUSING -- AGRICULTURAL AND BIOLOGICAL ENGINEERING
219 McAdams Hall
Clemson, S.C. 29634-0357
(803)656-3160 FAX (803) 656-0338

Housing Leaflet 250

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Questions About Indoor Air Quality?

South Carolinians want their homes to be free from indoor air pollutants and toxic substances that can affect the health of children and other family members. You spend 80 to 90 percent of your time indoors, and you may have family members with health conditions which are affected by pollutants.

While pollutant levels from a single source may not be a health risk, some homes have many sources which contribute to indoor air pollution. Fortunately, there are ways to control or eliminate most pollutants at a relatively low cost. These control measures will help you to achieve a healthy house.

This publication answers common questions about indoor air pollutants and discusses ways to reduce or eliminate the problems. For additional information about radon, contact the Clemson University Housing Institute or your County Extension Office for copies of "A Citizen's Guide to Radon," "How to Reduce Radon Levels in Your Home," and "Home Buyers and Sellers Guide to Radon."

What causes indoor air pollution problems?

Indoor air pollution results when man-made and natural chemicals, gases, particles, and other substances are produced or released in or near the home. Common pollutants found in homes are volatile organic compounds, formaldehyde, particulates, radon, asbestos, and combustion gases and by-products.

These pollutants come from a variety of sources such as household cleaning products, wood or fuels that are burned, building materials and products, furnishings, paint strippers, pesticides, the soil under a house, and human activities.

Some sources, like air fresheners, release pollutants almost continuously. Others, like unvented space heaters, produce pollutants occasionally or when they are used.

Has anyone set acceptable pollution levels for the home?

Pollution standards exist for outside air and for the work place, but there are no standards for pollutant levels in the home. However, when homes have been monitored, pollutant levels indoors have sometimes exceeded "safe" outdoor or work levels.

An "acceptable" pollution level in your home may depend on such varied factors as:

- whether or not family members have chronic illnesses - especially respiratory or illnesses aggravated by pollutants
- whether there are children or elderly family members who may be more sensitive to pollutant effects
- whether products or materials used in the home produce pollutants and how often they are used
- the effectiveness of your home ventilation system and the distribution of air throughout the house

How do indoor pollutants affect the health of my family?

You may feel the effects of exposure to an indoor pollutant immediately after exposure, or the problem may not show up until years later. Immediate effects include irritation of the eyes, nose, and throat; headaches; dizziness and fatigue. Age, preexisting conditions, and sensitivity to the pollutant can all affect whether a person reacts to a pollutant.

Other health effects may show up years after exposure or after repeated or long exposure. These effects can include central nervous system damage, chromosomal damage, and cancer.

Health effects associated with some indoor air pollutants are summarized in following table.

Table I: Common Indoor Air Pollutants, Sources, Health Impacts, Controls and Detection

Pollutant	Sources	Health Impacts	Controls*	Detection
Asbestos	Insulation on pipes and ducts, wood stove gaskets, ceiling tiles, resilient flooring and tiles, thermal insulation; deteriorating, damaged or disturbed insulation, fireproofing, or acoustical material	Lung cancer, asbestosis, mesothelioma	Do not disturb existing asbestos containing materials; for asbestos-containing materials that are friable (flaking or crumbling), coat with a sealant, enclose with airtight structure or have removed by a professional asbestos abatement contractor.	Bulk sample sent to lab for analysis: contact your county Extension office or DHEC for a list of laboratories; air sample taken by industrial hygienist using special equipment.
Biological contaminants	Molds, mildews, fungi, bacteria, viruses, dust mites; wet or moist walls, ceilings, carpets and furniture; poorly maintained humidifiers, dehumidifiers, and air conditioning; bedding, household pets	Allergies, respiratory irritation, infectious diseases; eye, nose and throat irritations; fever; humidifier fever; influenza	Control relative humidity in house; ventilation and use of outside vented exhaust fans; if humidifiers are used, clean reservoir daily with chlorine bleach or disinfectant, or follow manufacturer's instructions for cleaning; seal ductwork, especially those located in crawl spaces.	Air sample taken by industrial hygienist using special equipment; odor of mold and mildew; relative humidity can be checked with sling psychrometer or humidity sensor.
Combustion Products	Unvented space heaters (natural gas, kerosene, fuel oil, and charcoal), unvented gas stoves, wood stoves and fireplaces; tobacco smoke; human respiration; outside air	Headaches, drowsiness, dizziness (carbon dioxide); impairment of vision and brain functioning, irregular heart functioning, nausea, mental confusion, death (carbon monoxide); respiratory distress and lung damage (nitrogen dioxide)	Supply adequate combustion air for appliances, especially by use of outside air for combustion; have gas or oil furnaces and exhaust systems checked annually; use exhaust fans vented to outside; use catalytic converters on wood burning heaters; air cleaners. Eliminate use of kerosene space heaters.	Inexpensive carbon monoxide monitors available; check with county Extension office, county health department. No simple test for carbon dioxide; check with county health department. Dosimeters available for nitrogen dioxide available from industrial health and safety supply companies; check with county Extension office, county health department; consult gas utility supplier.
Formaldehyde	Pressed wood products (hardwood plywood wall paneling, particleboard, fiberboard) and furniture made with these pressed wood products; ureaformaldehyde foam insulation (UFFI) and furnishings made with ureaformaldehyde; finishes on home textiles, durable press drapes, and some glues	Irritation of skin, eyes, nose and throat; respiratory irritation, respiratory function impairment; cancer; chromosome damage	Use building materials with little or no formaldehyde; seal formaldehyde-containing floor and wall surfaces with vinyl flooring, vinyl wallpaper and formaldehyde-absorbent paint; air cleaners; ventilate area of house where formaldehyde-containing products are in use. House ventilation, outside-vented exhaust fans, air filters and cleaners; restrict use of products or equipment; use alternative products.	Dosimeters available; check with county Extension office, county health department. Visual identification by source and location; personal exposure meters, microenvironment samplers; check with county Extension office, county health department.
Particulates	Dust, pollen, cleaning and cooking sprays; environmental tobacco smoke; fireplaces, wood stoves, kerosene heaters, unvented gas or space heaters	Eye, nose, throat irritation; respiratory infections and bronchitis; lung cancer (long term risk)	Regularly change filters on heating/cooling systems and air cleaners; vent all furnaces to outdoors; eliminate unvented space heaters and gas appliances; have trained professional inspect, clean, and tune-up central heating system; repair leaks promptly.	Bulk sample sent to lab for analysis: contact your county Extension office or DHEC for a list of laboratories; air sample taken by industrial hygienist using special equipment.
Radon	Soil, well-water from private supplies	No immediate symptoms; lung cancer (long term risk); smokers at higher risk of developing radon-induced lung cancer	House ventilation; seal cracks in floors, walls and ceilings; soil ventilation; house pressure control; seal ductwork.	Test your home to determine radon level. Test kits available from county Extension offices in South Carolina. Monitors or detectors available: check with county Extension office, county health department for sources.
Volatile Organic Compounds	Household chemicals and products (including pesticides, painting supplies, solvents, adhesives, cleaners and waxes, moth crystals, air fresheners, fabric protectors, chlorine bleach), aerosol propellants; dry cleaned products; tobacco smoke and combustion processes	Range of possible effects from headaches, eye and respiratory irritations to central nervous system disorders; liver/kidney effects; cancer; chromosome damage	Follow use and storage instructions on labels. Use outside vented exhausts; increase ventilation in house; use solvents and paint products outside when possible; use alternative products; air cleaners.	Dosimeters to test for specific chemicals and materials available from industrial health and safety supply companies; check with county Extension office, county health department for sources; air sample taken by industrial hygienist using special equipment.

* Controls other than those mentioned may be suitable for individual houses; not all controls listed may be appropriate for individual houses

You and your doctor may not be sure of the cause of an illness. Most pollutants can't be seen, smelled, tasted or felt, and pollutant-related illnesses may mimic the effects of a cold or virus. Also, with many pollution sources in the house, it may be difficult to single out which ones are causing the problem. In addition, since some health effects take years to develop, a person may be unaware of a pollutant that may be contributing to future health problems.

How do I know if there is a pollution problem in my house?

If you are concerned about air quality in your house, you can make a common-sense diagnosis by documenting health complaints. You can also have tests done or samples taken to test for various pollutants.

Professionals often use the following questions when considering the possibility of indoor air pollution:

- What health complaints have been experienced by you or members of your family?
- Are complaints reported by more than one family member?
- When were these complaints first noticed?
- Can you associate these complaints with certain events or activities, like moving to a new house, remodeling, or adding new furnishings, carpeting or draperies?
- Do the health complaints occur seasonally, at a particular time of the day, or when a family member is in a particular part of the house?
- How often do the complaints occur and how long do they last?
- Do the complaints or reactions go away when you are away from the house? Do they return when you return home?
- Do visitors have the same reactions or health complaints?
- Are the complaints or reactions less severe when you ventilate the house?

Sampling techniques that detect and measure pollutants in your house vary in difficulty and expense. Testing for some pollutants, like volatile organic compounds (VOC), carbon dioxide and asbestos, may require a certified industrial hygienist using special equipment. These tests can cost up to several hundred dollars.

You can purchase inexpensive monitors or detectors which measure for formaldehyde, radon, nitrogen dioxide, water vapor and other pollutants. The devices can be installed and left in your house for a certain period of time. Usually you must return them to a laboratory for analysis. You'll receive test results and follow-up information from

the laboratory. The cost of analysis is often included in the purchase price of the monitor or detector.

One exception is asbestos. A homeowner can send a sample of a suspected asbestos-containing material to a lab for "bulk analysis." Ask the laboratory about how to take the samples and what safety precautions to observe.

If you suspect that there may be asbestos fibers circulating throughout your house, a different process is used. A sample for airborne asbestos fibers requires special equipment and the skills of a trained asbestos removal contractor or certified industrial hygienist. You may find these listed in the yellow pages or business section of your telephone directory.

Will I cause indoor pollution problems if I weatherize my home?

Some people who have made homes more energy efficient wonder if they've made the house too "tight." Symptoms associated with a "tight" house can be high relative humidity, interior mildew and molds, frequent condensation on windows or stale air.

Energy conservation measures do not cause indoor air pollution. But when you weatherize a house, you seal up cracks and openings and reduce the natural air flow through the house. When you add storm windows, weather stripping or caulking, concentrations of indoor air pollutants that are already in the home can increase.

On the positive side energy conservation measures increase your comfort and usually result in lower heating and cooling costs. You don't have to give up the benefits of weatherization. You can take steps to minimize pollution from sources inside the home. You can also dilute or remove the pollutants.

What can I do to reduce or remove pollutants?

There are three basic strategies to improve the air quality in your home.

➤ **Source control** is usually the most effective. Some sources, like an unvented kerosene space heater, can be eliminated or replaced with a more efficient, nonpolluting space heater. Other sources, like carpets and enamel paints which contain high levels of VOCs, or furniture which can contain high levels of formaldehyde can be replaced by materials with much lower levels, like latex paints or low-formaldehyde upholstery. Ask for these kinds of products where you normally buy the items. Other sources of pollutants, like the propellants in aerosol spray cans, can be eliminated by using a pump sprayer instead.

➤ **Improving ventilation** may lower the concentration of pollutants in your home. Simply opening windows and doors will usually increase the natural ventilation rate. Turning on bathroom or kitchen exhaust fans, which are vented to the outside, can remove pollutants from these rooms. If you have a radon problem, keep a window open when using fans so that more radon is not drawn through the soil and into the house.

NOTE: Exhaust fans can cause backdrafting of combustion appliances if there isn't enough replacement air entering the house. When this happens, combustion exhaust products may spill into the house. If your house is very tight, use a balanced system which includes both exhaust and intake of air.

Larger mechanical ventilation systems can be expensive to install and operate. Whole-house ventilation can be a part of the heating and cooling system or it can be totally separate. An exhaust-only system draws replacement air through various openings throughout the house. A balanced system adds fresh air intakes to supply the same amount of air which is exhausted from the house. The system might include some types of heat recovery which use outgoing warm air to preheat incoming cold winter air.

If you look into a whole-house ventilation system, be sure that:

- the system supplies fresh air to bedroom(s) and living areas,
- exhaust air is removed from the kitchen and bathroom(s), and
- the distribution system is effective to all other rooms in the house.

Sometimes source control can be less expensive than increasing ventilation which can also increase energy costs.

➤ **Air cleaners** can be effective for removing some pollutants. Air cleaners are generally designed to remove particles and some gases from the air.

The effectiveness of an air cleaner depends on:

- how well it collects pollutants from the air (percentage efficiency rate);
- how much air it draws through the cleaning or filtering element (cubic feet per minute) and
- whether it removes particles, gases or both.

The effectiveness of air cleaners for radon reduction in the home has not been established and at present is not recommended by the U. S. Environmental Protection Agency.

Where can I go for more information or assistance?

Your county Cooperative Extension Service office has additional materials on indoor air quality, sources of monitoring devices and names of local or county health agencies who can provide assistance. They can also refer you to an Extension specialist at Clemson University for general information as well as information about research, technical studies, and state and federal agencies who work with indoor air quality.

Your local health department may also be able to help or refer you to an appropriate state agency.

Your telephone directory yellow pages may also have listings for commercial firms which supply testing devices or other services. Check under such headings as "Industrial Hygienists," "Formaldehyde Dosimeters," "Asbestos Sampling/Removal," "Pesticide Sampling," "Radon Dosimeters/Samplers," and "Industrial Health and Safety Supply."

Glossary

Backdrafting - A condition in which the normal movements of combustion gases up a flue is reversed, causing the combustion products to enter the home. Backdrafting can occur when depressurization in the house overcomes the natural tendency of the exhaust gases to rise.

Exhaust Fan - A fan which blows indoor air out of a house. Exhaust fans can cause outdoor air and radon to leak in at other parts of the house to make up for the air blown out by the exhaust fan. Exhaust fans can also cause backdrafting.

Heat Recovery Ventilators/Heat Exchangers - Equipment used to transfer heat from one air flow to another. Heat from indoor air being exhausted to the outside is transferred to incoming air from the outdoors without the two air flows being mixed.

Infiltration - The unplanned movement of outdoor air or radon into a house through leaks and cracks in the house.

Radon - Radon is the only naturally occurring radioactive gas. The term is usually used to refer to radon-222, the radon isotope which is present inside houses. Radon-222 is directly created by the decay of radium-226 and has a half-life of 3.82 days.

Tight House - A house with a low air exchange rate, often below 0.5 air changes per hour (ACH).

Ventilation Rate - The rate at which outdoor air enters a house displacing indoor air. The ventilation rate depends on the house construction, weather conditions, and the use of appliances (like fans) that affect air movement. The rate is commonly expressed in terms of ACH or cubic feet per minute. It includes both natural ventilation (infiltration) and mechanical ventilation.

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This publication was adapted, with permission, by Craig Dewitt, Clemson Extension Housing Specialist, from a similar document published by North Carolina State University.

For more information contact any of these numbers:
 Clemson University Housing Institute (803) 656-0114
 South Carolina Department of Health and Environmental Control (800) 768-0362
 United States Environmental Protection Agency (800) SOS-RADON.

County Extension Offices

County	Telephone	County	Telephone	County	Telephone	County	Telephone
Abbeville	459-4106	Chesterfield	623-2134	Hampton	943-3621	Oconee	638-5889
Aiken	649-6671	Clarendon	435-8429	Horry	248-2267	Orangeburg	534-6280
Allendale	584-4207	Colleton	549-2596	Jasper	726-3470	Pickens	868-2810
Anderson	226-1581	Darlington	393-0484	Kershaw	432-9071	Richland	929-6030
Bamberg	245-2661	Dillon	774-8218	Lancaster	283-3302	Saluda	445-8117
Barnwell	259-7141	Dorchester	563-3441	Laurens	984-2514	Spartanburg	596-2993
Beaufort	525-7118	Edgefield	637-3161	Lee	484-5416	Sumter	773-5561
Berkeley	761-6900	Fairfield	635-4722	Lexington	359-8515	Union	427-6259
Calhoun	874-2354	Florence	661-4800	McCormick	465-2112	Williamsburg	354-6106
Charleston	722-5940	Georgetown	546-4481	Marion	423-8285	York	684-9919
Cherokee	489-3141	Greenville	232-4431	Marlboro	479-6851		
Chester	385-6181	Greenwood	229-6681	Newberry	276-1091		



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