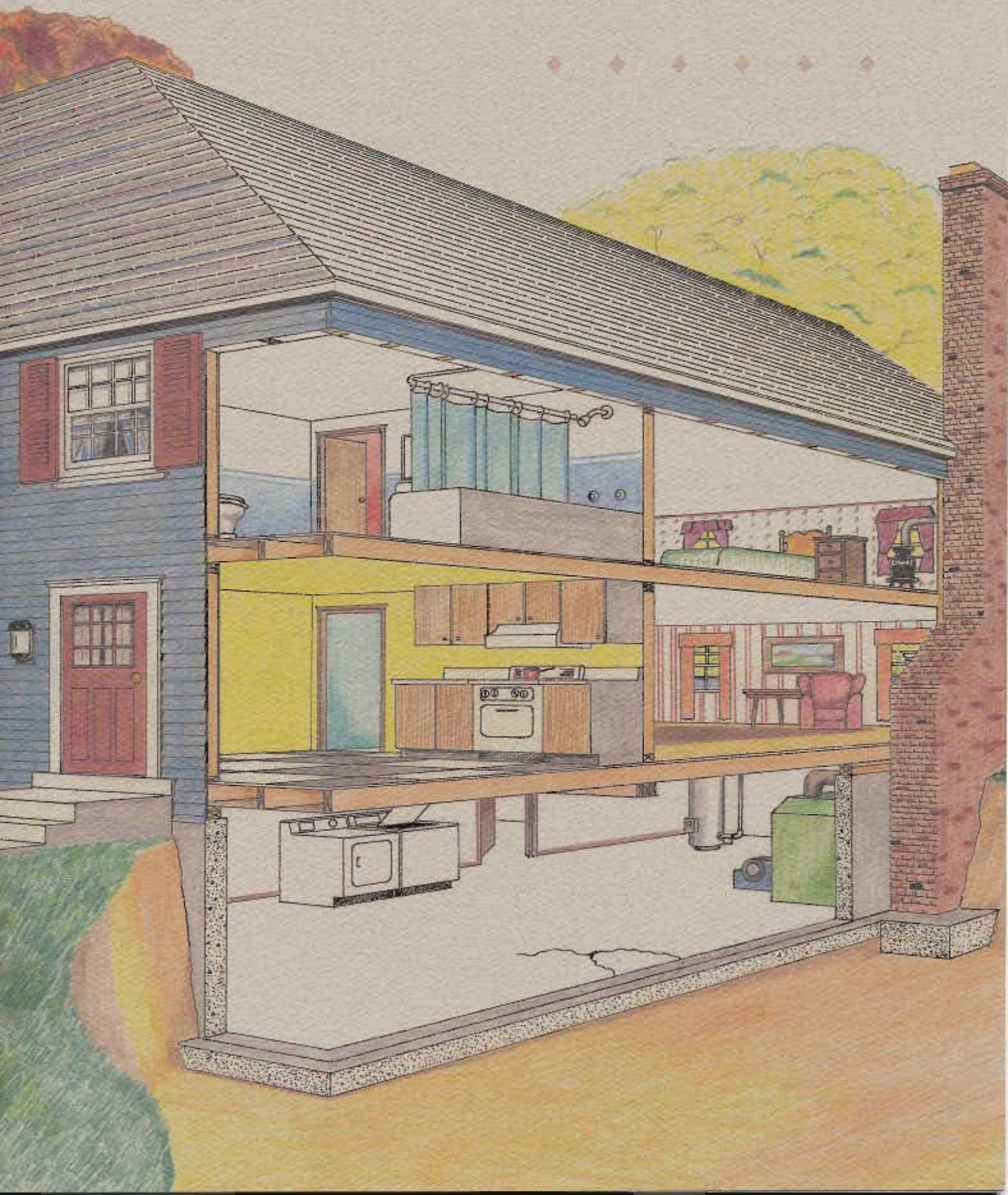


INDOOR AIR QUALITY

AND YOUR HEALTH



INTRODUCTION

People have long recognized the problems associated with pollution in the air that we breathe. Over the last century, most of the efforts to research and control air pollution have focused on outdoor air. In recent years, however, the quality of the air within our dwellings has begun to receive increasing attention. Researchers have found that pollutants such as radon gas, formaldehyde, asbestos, and combustion by-products commonly reach much higher concentrations in indoor air than they do in outdoor air. Since the average person spends 75% to 95% of his or her time living and working in an indoor environment, high concentrations of air pollutants in our homes can pose health risks.

This booklet is designed to help you better understand the problem of indoor air pollution and to assist you in determining whether the quality of air inside your home or workplace is poor. For a quick check on whether you might have an indoor air quality problem, fill out the questionnaire on the adjacent page. The table on pages 10 and 11, "Some Significant Indoor Air Pollutants," will provide you with basic information on the most common indoor air pollutants. Other sections of this booklet contain more detailed information on detecting pollutants and improving indoor air quality without compromising the integrity of tightly-built, energy-efficient buildings. State and private agencies that can assist you with more information and testing are listed on pages 12 and 13.

We hope that you find this booklet to be helpful. When you are finished with it, we suggest that you pass it on to a friend.

ACKNOWLEDGEMENT

We would like to thank Richard Karg of R. J. Karg Associates for his assistance in writing the text for this booklet. We are also grateful to the State of Maine - Office of Energy Resources for granting us permission to use their booklet, entitled "Indoor Air Quality and Your Health," as the foundation for this booklet. Finally, we wish to express our appreciation to William Turner of Harriman Associates and Terry Brennan of Camroden Associates for their comprehensive review and comments.

Granite State Electric Company
Massachusetts Electric Company
The Narragansett Electric Company
New England Power Company
Massachusetts Audubon Society
Massachusetts Department of Public Health
Massachusetts Executive Office of Energy Resources

State of New Hampshire - Governor's Energy Office
State of New Hampshire - Public Health Services
State of Rhode Island - Department of Health
State of Rhode Island - Governor's Office of Energy Assistance



CHECK YOUR INDOOR AIR QUALITY

- | | YES | NO |
|---|--------------------------|--------------------------|
| 1. Is asbestos insulation cracking or flaking in any area in your home? | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Does your home contain large amounts of particle board, paneling, new carpeting, or new furniture? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Do you or anyone in your household experience any of the following symptoms when home but not when away from home? | <input type="checkbox"/> | <input type="checkbox"/> |
| a. Headaches | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Burning eyes | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Feelings of confusion | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Heartburn or abdominal pain | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Breathing difficulties | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Allergies | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Drowsiness | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. During cold weather, do you notice excessive condensation of water or ice on windows, walls or ceilings? | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Does your dwelling usually smell stuffy when you enter from the outside? | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Do you have mold growing in your home? | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Do the odors of cooking linger for a long time (several hours)? | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Is your foundation constructed of granite stones? | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Do you have a dirt floor in your cellar? | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Do you often use potentially harmful chemicals in your home or place of business? Examples are hair sprays, cleaning agents, glues, pesticides, fabric softeners, paints, perfumes, solvents and deodorizers. | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Is your water supply from a deep well drilled in granite bedrock? | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. Do you live with people who smoke cigarettes, cigars or pipes? | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. If you heat your home with a gas or oil hot air furnace, do you ever smell gas or oil fumes? | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. If you heat with wood, do you often smell wood smoke? | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Do you have any unvented combustion heating units in your home? | <input type="checkbox"/> | <input type="checkbox"/> |

If your answer to any of these questions is "yes," the air quality in your dwelling might be harmful. Read this booklet carefully to determine how to detect indoor air quality problems and how to improve the quality of the air in your home.

THE PROBLEM

Indoor air pollutants pose a problem because they affect human health to varying degrees depending on the particular pollutant, the level of concentration in the air, and the sensitivity of the individual. The large proportion of time that most people spend inside buildings increases the likelihood that poor indoor air quality may cause adverse reactions such as allergies, eye irritation, headaches, feelings of confusion, and drowsiness, as well as more serious, long-term health effects.

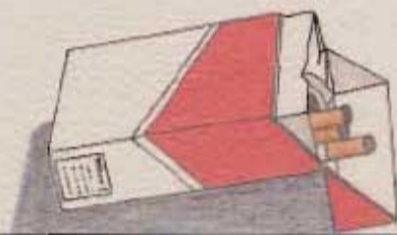
Concern over indoor air quality has increased over the last decade for two reasons. First, we have continually increased the types and quantities of pollutants we bring into our homes. Formaldehyde, for example, is emitted from some wood products, certain insulations, and some home furnishings. Harmful chemicals are found in cleaning agents, aerosols, paints, hair sprays, fabric softeners, perfumes and deodorizers. Radon, a naturally occurring radioactive gas, has been found in numerous homes across the country.

Increased concern also results from a better awareness of indoor air pollutants. Over the last decade, we have carefully tested and studied indoor air, and as a result, have identified many irritants and health risks. Radon gas, for example, has apparently existed in some dwellings for hundreds of years, but we have only recently identified it and determined its health risk. Other pollutants, such as formaldehyde, have recently been identified as irritating to some individuals.

A frequently-asked question is whether heavily insulated, "tightened" buildings are more likely to have lower air quality than standard buildings. The question arises because this type of building has a reduced flow of fresh air entering it, and stale air leaving it. Fortunately, studies to date have shown that there is not a strong relationship between indoor air quality and the degree of tightness of buildings that do not have preexisting indoor air quality problems. These studies have also shown that tightening homes that have preexisting indoor air pollution problems may not necessarily worsen indoor air quality. As a precaution, however, controlled mechanical ventilation is recommended in tight homes to supply fresh outside air and reduce levels of some pollutants.

According to recent research, our attention should be focused on the sources of pollutants in our homes, including those sources classified as building materials and furnishings; those that we carry into and use in our homes, such as cleaning agents and paints; and those that may exist in the soil around our homes, such as radon.

The large proportion of time that most people spend inside buildings increases the likelihood that poor indoor air quality may cause adverse reactions.



SOURCES OF INDOOR AIR POLLUTANTS

A pollutant is anything that makes the air "dirty" so that it is unpleasant or unsafe to breathe. Some pollutants seep into our homes from the outside. Some come from building materials and furnishings. Others we might routinely bring in or create.

Many indoor air pollutants have been identified, and perhaps more will be discovered. Listed by source, the most common types:

1. Are given off by building materials and furnishings. Formaldehyde is emitted from some particle board, plywood paneling and urea formaldehyde insulation; radioactive radon gas may be released from granite foundations; and asbestos fibers may be found in the air near materials containing asbestos.
2. Enter buildings through cracks and holes in cellars or crawl spaces or other parts of the structure. Radon gas, water vapor and auto exhaust fumes are examples.
3. Exist naturally within most dwellings but cause little harm unless their concentrations are high. Water vapor is a good example. At reasonable levels—30% to 40% relative humidity—it does not cause any problems. However, at high levels it promotes the growth of mold and mildew and can increase concentrations of formaldehyde.
4. Result from our use of various chemicals such as paints and varnishes, cleaning agents, perfumes and pesticides.
5. Are created when we burn something in the house and do not properly vent the waste products to the outside. Some sources are unvented gas ranges, unvented kerosene heaters, cigarette smoke and defective flues and chimneys.

Table I, on pages 10 and 11, "Some Significant Indoor Air Pollutants," lists the major pollutants, potential health effects and other important facts.

[Note: Some local building codes contain minimum ventilation standards. These standards should be followed closely. Contact your local building inspector for more information.]



D DETECTING INDOOR AIR POLLUTANTS

Many air pollutants are not detectable by sight or smell. Radon gas, carbon monoxide and nitric oxide are examples. Other pollutants are evident only in high concentrations. Formaldehyde, for example, may have a pungent smell at high levels but no smell at lower—yet still irritating—levels.

Some simple, although imprecise, ways exist to detect poor indoor air quality. One is by assuming that if relative humidity is excessive, and no major sources of moisture such as a humidifier are present, the ventilation rate in your home may be too low. Therefore, the concentrations of other pollutants might also be excessive. You can tell if the relative humidity is too high if your home feels damp during the winter months or if you notice abnormally large amounts of condensation on your windows, walls or ceiling surfaces.

Another simple method of detecting poor air quality is to use your nose. If you sense a high "stuffiness level" or if the odors of cooking linger too long, the ventilation in your house might be inadequate.

Devices for detecting many pollutants in air and water are available from state and private laboratories. Professionals from these organizations will tell you where to place the device in your home and when to send it back for analysis. Radon, formaldehyde, carbon monoxide, and nitrogen dioxide are some of the pollutants that can be identified with inexpensive detectors.

If the source of a bothersome pollutant cannot be detected by one of these devices, state and private laboratories often have technicians available to visit homes for on-site analysis. This can be costly for the homeowner but usually is very helpful. However, in some cases, professionals may not be able to determine the specific sources of pollutants.

In addition, detecting the sources of indoor air pollutants may be difficult in homes with occupants who smoke. This is because cigarette smoke contains many irritating pollutants and may mask other pollutants.

Please refer to pages 12 and 13 for a listing of organizations that can help you detect and alleviate indoor air quality problems. ♦

There are a few simple ways to detect poor indoor air quality. ♦

IMPROVING INDOOR AIR QUALITY

Two basic methods are used for lowering the concentrations of indoor air pollutants:

1. Source control
2. Pollutant removal
 - a. Ventilation
 - b. Air cleaning

1. Source control

Source control involves reducing pollutant emissions from existing sources within the indoor environment. Source control is important because the pollutant concentration emanating from the source has been shown to be the most influential factor in determining levels of indoor air pollutants. Some important source control methods are described below.

Particle board, plywood and other new building materials that may emit formaldehyde to indoor air can be sealed with a varnish to reduce the release of this irritating chemical.

Holes and cracks in your basement should be filled to prevent the entry of radon gas into the dwelling from soil around the foundation. When building a new foundation, the fewer the number of joints, cracks and holes, the better. A poured concrete foundation wall and basement slab floor will seal out radon better than other foundation materials.

Any material containing asbestos should be left undisturbed so that asbestos particles do not become airborne. However, if asbestos in your home is cracking or flaking, contact a state-certified asbestos abatement contractor to remove the source. The Departments of Public Health, listed on pages 12 and 13, can provide names of contractors.

Read directions and warning labels on cleaning agents, solvents and paints before using them and wear appropriate eye, ear and skin protection. If possible, use these materials outside or, if used inside, use them with ample cross-flow ventilation.

Attempt to maintain a relative humidity of about 30% to 40% during the heating season. Higher relative humidity levels can lead to the growth of mold, mildew, house-dust mites and other irritating organisms. If humidifiers must be used to maintain 30% to 40% relative humidity during the heating season, regularly clean the water reservoir with a mild chlorine solution to control mold and mildew growth.

Properly maintain all wood stoves, gas and oil heating systems, hot water heaters, gas ranges, flues and chimneys. Malfunctions such as incomplete combustion, blocked chimneys or poor drafting may create a dangerous situation. Plan a regular inspection and maintenance schedule for your combustion appliances and then stick to it.

Select building materials with indoor air quality in mind.

Outside air for combustion should be ducted directly to any combustion device that has an exhaust flue, including wood stoves and oil and gas heating systems. This practice ensures complete combustion and proper draft up the chimney, and reduces the chance of backdrafting (the flow of combustion gases back into the home). It is particularly important after a house has been tightened to check for proper venting of all combustion devices because severe cases of backdrafting have caused carbon monoxide poisoning resulting in death.

The wall joining the attached garage to the house should be tightly constructed so that automobile exhaust fumes will not leak into the living space. As additional precautions, the door leading from the garage to the house should be tightly weatherstripped and return-air heating ducts should not pass through the garage. Automobile engines should never be operated in a closed garage.

Select building materials with indoor air quality in mind. For example, try to avoid using construction materials containing high levels of formaldehyde if the materials will be exposed to indoor air.

Some furnishings contain formaldehyde and other irritating chemicals. Talk with suppliers about the chemical content of home furnishings before buying, but be aware that they might not have the answers you are looking for. It is often very difficult to determine whether materials contain high concentrations of a particular chemical.

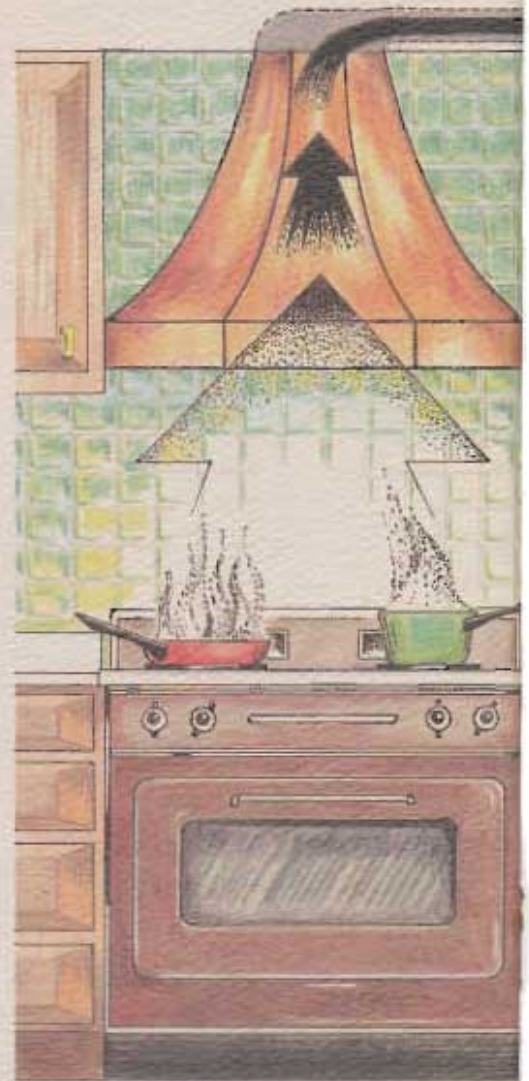
2. Pollutant removal

a. **Ventilation** is the movement of air and its contained pollutants out of a house, either by natural air leakage or mechanical ventilation. Of course, as air moves out of a dwelling, outside air always moves in to replace it. Ventilation is not a substitute for source control, but it is a useful additional measure.

Fresh air can get into a building and stale air can get out in two ways: infiltration/exfiltration and mechanical ventilation. Infiltration/exfiltration is a result of air leaking into and out of a building through cracks and holes. This air movement is due to air pressure variations between the interior and exterior of the home and the opening of windows and exterior doors. Air pressure variations can be caused by 1) the wind blowing against one side of a building and away from the opposite side, 2) the "stack effect" when the house itself acts as a chimney, with cold air entering the lower portions of the structure and heated, lighter air exiting through the upper portions, and 3) combustion appliances exhausting combustion gases up chimneys and causing air to be pulled into the structure to replace these hot gases.

Infiltration and exfiltration take place to varying degrees in different homes. If they are excessive, the homeowner or tenant may suffer. This uncontrolled air flow can cause discomfort and increase energy bills.

Mechanical ventilation is the airflow out of and into a building resulting from pressure differences caused by fans or blowers.





Mechanical ventilation is the approved method of ventilating a home because of the increased control over infiltration/exfiltration. In tightly-built new and old homes, mechanical ventilation is highly recommended. Common examples of mechanical ventilation are kitchen and bathroom exhaust fans and heat recovery ventilators.

Standards developed for intermittent residential ventilation indicate that bathrooms and kitchens should have exhaust fans that can exhaust at least 50 and 100 cubic feet per minute, respectively. Exhaust fans push out air from a building at the location of the fan and pull in an equal amount of air somewhere else in the building, usually in a haphazard manner. It is best to provide an adequate supply of fresh air to the area of the house where the exhaust fan is installed. This lessens the possibility that the exhaust fan will cause building depressurization and its accompanying difficulties, such as increased radon or formaldehyde concentrations.

Heat recovery ventilators (exhaust and supply ventilators with heat recovery capabilities, sometimes called air-to-air heat exchangers) are often recommended for new, tightly-built homes. These machines simultaneously exhaust stale air and supply fresh air and have the advantage of transferring most of the heat energy in the exhaust air to the incoming air. Ductwork, registers and grilles are attached to the heat recovery ventilator in a manner similar to that of a hot air heating system. These systems can be controlled either manually or automatically.

Today it is recommended that tight homes have a planned ventilation system. The system might be as simple as bathroom and kitchen exhaust fans or as complex as a heat recovery ventilation system.

Ventilation does not always reduce pollution levels. For example, exhaust ventilation without make-up air has been known to increase radon gas concentrations in a home. This can occur because an exhaust fan without make-up air can cause building depressurization resulting in more radon gas moving from the soil around the foundation into the basement through cracks in the foundation walls and floor. Contact the experts listed on pages 12 and 13 for more information regarding ventilation.

b. **Air cleaning** is the second method of removing indoor air pollution. It is not a substitute for fresh outside air. Air filters, ionizers, and electrostatic precipitators can effectively rid indoor air of some microscopic particles such as dust and some combustion products, but they do not totally purify and revitalize the air. These devices must be sized and maintained properly in order to work effectively. Often air cleaning is used in combination with ventilation systems to provide clean, fresh air throughout the house.

An advantage of some air cleaners is their ability to remove some particles, such as pollen, that originate outside. A disadvantage is that they have no effect at all on the concentrations of some pollutants such as formaldehyde, carbon monoxide, and other gases. ♦

S SHOULD HOUSES BE BUILT TIGHTLY?

Most experts agree that the answer to this question is "yes." But then, as a homeowner, you might ask: "If I build my new home tightly or tighten up my existing home by weatherstripping and caulking, isn't it likely that the indoor air quality will worsen?" The answer to this second question is "no," provided you follow the two methods of pollution control listed on pages 5 through 7 in this booklet:

1. Source control
2. Pollutant removal
 - a. Ventilation
 - b. Air cleaning

On the other hand, not following these guidelines may increase the chances that you will have lower indoor air quality if strong pollutant sources exist in your home.

Tightening and insulating our homes can be expensive and require extra work and planning; however, these measures also offer us many advantages. Most importantly, they enable us to decrease our heating bills and increase our levels of comfort and the value of our homes. They do not, however, necessarily lead to increased levels of indoor air pollution. In fact, scientific studies to date show that there is not a strong relationship between tightening up a house and concentrations of indoor air pollution in homes that do not have preexisting indoor air quality problems. These studies have shown instead that the primary factor affecting levels of indoor air pollution is the pollutant source strength. Consequently, in dealing with indoor pollution, the most important step to take is to determine, if possible, the source of pollution and then follow the

Studies have shown that the primary factor affecting levels of indoor air pollution is the pollutant source strength. ♦



The installation of mechanical ventilation systems is frequently recommended for tight homes. ◆

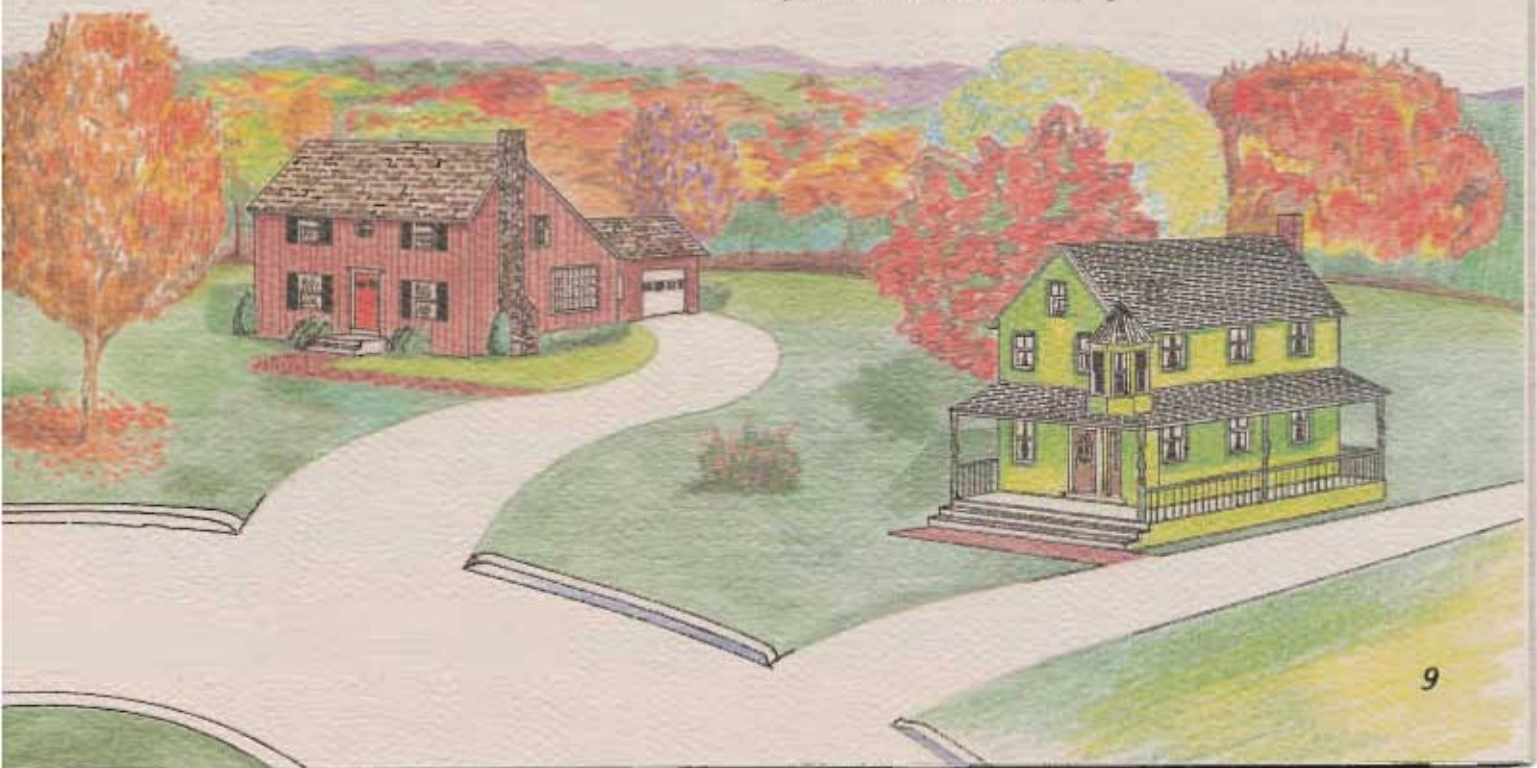
methods described in this booklet. First, reduce the pollution emissions in your home (source control) and second, reduce the pollution concentrations by ventilation (pollutant removal) and, if necessary, by air cleaning (pollutant removal).

If we do not tighten our homes, our energy use and heating bills may be higher, our living environment may be more drafty and less comfortable, and the insulation and framework may be damaged by interior water vapor condensing within the walls, ceilings and floors. In addition, the possibilities of high concentrations of some pollutants are greater in loosely constructed buildings. Radon gas, for example, is pulled into the house through cracks in the basement slab floor and walls as a result of air leaking out of the upper portions of the house. This "stack effect" is stronger in leaky houses than in tight houses.

For improved comfort and as a precaution against increased indoor air quality problems in tight homes, the installation of mechanical ventilation systems is frequently recommended. These systems may be controlled manually or automatically and, if operated and maintained properly, will ensure a supply of fresh air and help reduce levels of some indoor air pollutants. As discussed in the section "Improving Indoor Air Quality," a wide range of mechanical ventilation devices is available, from low cost exhaust fans to more expensive whole-house heat recovery ventilators.

If you are constructing a new home or renovating an existing one, it is recommended that you insulate, tighten and follow the basic pollution control methods explained in this booklet. By following these control methods, you should be exposed to less indoor air pollution, save heating dollars, feel more comfortable, and enjoy a more durable and valuable building. ◆

[Note: Some local building codes contain minimum ventilation standards. These standards should be followed closely. Contact your local building inspector for more information.]



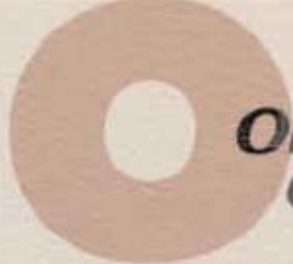


SOME SIGNIFICANT INDOOR AIR POLLUTANTS

POLLUTANT	SOURCES	DETECTION
<p>ASBESTOS A natural mineral used in various building materials. If the fibers are inhaled, they can be trapped in the lungs.</p>	<ul style="list-style-type: none"> • Some wall and ceiling insulation installed between 1930 and 1950. • Old insulation on heating pipes and old heating equipment. • Old wood stove door gaskets. • Drywall joint-finishing material and textured paint purchased before 1977. • Some older vinyl floor tiles. • Cement-asbestos millboard and exterior house wall shingles. (Note: If the asbestos fibers remain bound within these materials and do not create dust, the occupant is not at risk.) • Old fireproof cloth products. • Some sprayed and troweled ceiling finish plasters installed between 1945 and 1973. 	<ul style="list-style-type: none"> • It can be detected by certified asbestos abatement contractors. • If you have an asbestos-containing product in the open that is disturbed by vibration or contact, asbestos particles may be in the air.
<p>CLEANING AGENTS & AEROSOLS Most of these chemicals are hydrocarbons that act as solvents in cleaning agents. Also, hydrocarbons often serve as propellants for aerosol products.</p>	<ul style="list-style-type: none"> • Cleaners, paints, hair sprays, glues, fabric softeners, pesticides, perfumes, deodorizers. 	<ul style="list-style-type: none"> • Most of these chemicals have a detectable odor at high concentrations. • Low concentrations can be detected by professionals.
<p>COMBUSTION BY-PRODUCTS Include particles, carbon monoxide (CO), carbon dioxide (CO₂), nitric oxide (NO), nitrogen dioxide (NO₂) and partially oxidized organics.</p>	<ul style="list-style-type: none"> • Combustion, including gas ranges, wood stoves, tobacco smoke, unvented heaters, and fireplaces. • Automobile exhaust. • Incomplete combustion of fuels. • Unvented combustion gases. 	<ul style="list-style-type: none"> • Combustion particles can usually be detected by their odor when at high concentrations. • The gases listed are odorless and colorless, but can be detected by professionals. • Certain combustion byproducts such as tobacco smoke and wood smoke are particularly strong in odor.
<p>FORMALDEHYDE (HCHO) A colorless, water-soluble gas that may have a detectable odor at high concentrations.</p>	<ul style="list-style-type: none"> • Some particle board, plywood, pressboard, paneling, carpeting, upholstery and furniture. • Urea formaldehyde insulation (used in walls, mainly during 1970s). • Some household cleaners and deodorizers. • Gas stoves, tobacco smoke and poorly vented wood stoves. • Mobile homes often have higher concentrations than wood-framed homes. 	<ul style="list-style-type: none"> • Pungent odor from certain types of new carpeting or particle board. • Professionals can detect with special tests.
<p>ORGANISMS AND MICROBES Broad terms encompassing most microscopic particles, living plants and animals, including fungi, mold, mildew, house dust mites, virus, bacteria, animal dander and respirable particles.</p>	<ul style="list-style-type: none"> • Mold, mildew and other fungi thrive in damp, humid places. • Humidifiers. • Air conditioners. • Heating systems if dirty or wet. • House dust. 	<ul style="list-style-type: none"> • Most are only detectable with special equipment used by professionals. • Odor of mold and mildew.
<p>RADON A radioactive gas formed as a by-product in the decay chain of uranium 238. When radon is in the air, its progeny (radioactive offspring) are also in the air.</p>	<ul style="list-style-type: none"> • Radon gas emanates from rocks and enters through cracks and holes in the foundations, slab or dirt floor. • Water from some private drilled wells. • Some building materials, such as granite. 	<ul style="list-style-type: none"> • Odorless and colorless. • Special charcoal canisters and track-etch detectors which are sent to a laboratory for analysis. • Special electronic meters which measure the radioactivity emitted during the decay of radon and its progeny. • Laboratory-conducted test of water from private drilled wells.
<p>WATER VAPOR Water in gaseous form, an ever-present constituent of air. Too much water vapor in the air can be harmful while too little can be uncomfortable. Water vapor can act as a vehicle and catalyst for other pollutants.</p>	<ul style="list-style-type: none"> • Household activities such as showering, bathing, and cooking. • Human respiration. • Unvented combustion. • Improper drainage around house. 	<ul style="list-style-type: none"> • Excessive condensation on windows. • Condensation on walls and ceilings. • Musty smell. • Can be tested with a sling psychrometer.

TABLE 1

POTENTIAL HEALTH EFFECTS	CONTROL METHODS
<ul style="list-style-type: none"> • Skin contact with asbestos may cause severe irritation. • Long term inhalation can lead to coughing, chest pain, weakness and lung cancer. • Mesothelioma (cancer of lining of chest and abdomen). • Asbestosis (scarring of the lung tissue). 	<ul style="list-style-type: none"> • Do not use materials containing asbestos. • Use fiberglass wood stove gaskets. • Do not disturb materials containing asbestos. • If a material containing asbestos is damaged or needs repair, contact a certified asbestos abatement contractor. • Do not sand floors that had vinyl floor tiles manufactured with asbestos.
<ul style="list-style-type: none"> • Irritation of mucous membranes of nose. • Headaches • Heartburn and abdominal pain. • Mental confusion. • Possible serious long-term effects. 	<ul style="list-style-type: none"> • Read labels before using. • If you must use hazardous chemicals, try to use outside of your house. • If used inside, cross ventilate area with fan and open windows. • Follow directions and do not mix products together. • Store products safely, cap tightly. • When possible, use products that are less hazardous. • Air out freshly dry-cleaned clothes before wearing.
<ul style="list-style-type: none"> • Impaired vision. • Drowsiness. • Emphysema. • Heart disease. • Respiratory infections. • Reduced lung capacity. • Lung cancer. • Death from carbon monoxide. 	<ul style="list-style-type: none"> • When cooking, use a kitchen exhaust fan that is vented to the outside. • Keep combustion appliances properly adjusted. • Do not use unvented combustion appliances. • Do not warm up car in attached garage. • Use pilot-less ignition on gas appliances. • Exhaust smoking area and provide a fresh air supply. • Inspect and maintain all fuel-burning equipment. • Properly maintain chimneys, solid fuel stoves, and fireplaces to avoid leaks.
<ul style="list-style-type: none"> • Eye irritation. • Feeling of pressure in head. • Upper respiratory irritation. • Lower respiratory irritation and pulmonary effects. • Pulmonary edema, pneumonia. (Note: The sensitivity to formaldehyde varies widely.) 	<ul style="list-style-type: none"> • Remove source if identifiable. • Try to avoid products which contain high levels of formaldehyde. • If plywood, particle board or pressboard is used in the dwelling, use low-formaldehyde types if possible. • Avoid high relative humidity within the dwelling. • Seal particle board, pressboard and paneling containing high levels of formaldehyde with varnish or vinyl wallpaper. • Ventilate space containing formaldehyde odors. • Professional chemical fumigation may neutralize formaldehyde. (Note: It may be difficult to determine the level of formaldehyde in a product or whether product contains formaldehyde.)
<ul style="list-style-type: none"> • Allergic reactions. • Headaches. • Flu symptoms. 	<ul style="list-style-type: none"> • Maintain dwelling relative humidity between 30% and 40% in winter. • Wash inside of humidifier weekly with mild chlorine solution. • Use exhaust fans that vent to the outside in bathrooms and kitchens. • Control source of irritants. • Ventilate crawl spaces and basements during warm weather. • Install polyethylene ground cover over bare ground in crawl space and basement.
<ul style="list-style-type: none"> • Major cause of lung cancer. 	<ul style="list-style-type: none"> • Seal cracks and holes in foundation walls and concrete slabs. • Install water traps in basement floor drain pipes. • Install 6 mil polyethylene under new basement slabs. • Install a ventilation system under basement slabs. • Ventilate basement or crawl space by exhausting air or by installing heat recovery ventilation which exhausts and supplies air. • Tightly seal sump holes in basement slabs or, in special cases, ventilate sump holes to the outside. • If well water contains radon, filter water with special charcoal filter or aerate water with appropriate system. • Retest for radon after implementing control methods.
<ul style="list-style-type: none"> • Increase in allergic reactions, including asthmatic attacks, to house-dust mites, mold and mildew, and chemicals. • If formaldehyde is present, its concentration increases at higher relative humidities. 	<ul style="list-style-type: none"> • Control water vapor production within dwelling. • Keep relative humidity between 30% and 40% in winter. • Do not vent clothes dryer to the inside, especially a gas dryer. • Use fans that vent to the outside in bathrooms and kitchens when rooms are in use. • Try to avoid using a humidifier. • Drain water away from foundation. • Cover dirt floors in crawl spaces and basements with plastic sheeting.



ORGANIZATIONS AND STATE AGENCIES OFFERING INFORMATION, HELP AND TESTING SERVICES

MASSACHUSETTS

- **American Lung Association of Massachusetts**
803 Summer Street
Boston, MA 02127
Telephone: (MA only) 800-522-2911
or 617-269-9720

The American Lung Association of Massachusetts offers to the public numerous brochures, fact sheets, pamphlets and audio-visuals about indoor air pollutants. The Association can also provide lists of testing and mitigation services.

- **Department of Public Health**
150 Tremont St.
Boston, MA 02111
Telephone: 617-727-2660
or 1-800-222-UFFI

The Massachusetts Department of Public Health can provide consultation and limited testing for homeowners experiencing indoor air quality problems. Additionally, the Department operates a program which provides removal of urea-formaldehyde foam from individual homes when the formaldehyde air level is greater than 0.1 ppm or there are documented negative health effects. The Department also provides

information on radon and its elimination, and will conduct surveys of homes with initial radon readings of greater than 20 picocuries per liter.

- **Executive Office of Energy Resources**
100 Cambridge St. 15th Floor
Boston, MA 02202
Telephone: 617-727-4732

The Executive Office of Energy Resources (EOER) operates the Home Energy Assistance Team (HEAT) program which offers zero percent interest loans and technical assistance to eligible residential building owners and tenants who are making energy efficiency improvements. Among the items relating to indoor air quality which are eligible for a HEAT subsidy are heating system improvements and asbestos abatement work necessary in order to perform these heating system improvements. Basic information and literature on the relationship between energy conservation improvements and indoor air quality is also available through the network of regional organizations which operate the HEAT program for EOER. Other EOER subsidy programs serving the public and institutional sectors may also assist asbestos abatement in connection with heating or cooling system improvements.

NEW HAMPSHIRE

- **American Lung Association of New Hampshire**
456 Beech Street
P. O. Box 1014
Manchester, NH 03105
Telephone: 603-669-2411

The American Lung Association of New Hampshire provides a variety of services relating to indoor air quality. These include lists of pollutant testing and mitigation services, radon test kits, and a wide range of literature and audiovisuals on indoor air pollution.

- **Public Health Services Health Risk Assessment Unit**
Health and Human Services Building
6 Hazen Drive
Concord, NH 03301
Telephone: 603-271-4664

- **Public Health Services Occupational Health Program**
Health and Human Services Building
6 Hazen Drive
Concord, NH 03301
Telephone: 603-271-4676

Public Health Services helps homeowners detect and control indoor air quality problems. It also has literature on specific indoor air pollutants.

NEW HAMPSHIRE, cont.

- **Governor's Energy Office**
2½ Beacon Street
Concord, NH 03301
Telephone: 603-271-2711

The Governor's Energy Office (GEO) provides technical assistance on energy efficiency and its relationship to indoor air quality. General questions concerning radon gas, formaldehyde, wood smoke, moisture problems and stale air are answered in-house while more detailed questions are referred to the appropriate state agency, one of the federal technology assistance services or to the private sector.

The GEO also sponsors an Indoor Air Quality program with the Department of Environmental Services to provide a public education program to alert people about potentially hazardous household wastes and mechanisms for removing them without reducing energy efficiency.

RHODE ISLAND

- **Governor's Office of Energy Assistance**
275 Westminster Mall
Providence, RI 02903-3393
Telephone: 402-277-3370

The Governor's Office of Energy Assistance provides technical assistance on indoor air quality problems to low-income families.

- **Department of Health**
Division of Occupational Health and Radiation Control
206 Cannon Building
75 Davis Street
Providence, RI 02908
Telephone: 402-277-2438
or 401-277-3601

The Department of Health provides assistance to homeowners and business people in assessing general air quality concerns. The Department is available to evaluate the adequacy of ventilation systems, test for the presence of specific air contaminants such as carbon monoxide and formaldehyde, provide assistance in radon detection and mitigation, and provide guidance to homeowners in asbestos abatement.

- **Rhode Island Lung Association**
10 Abbott Park Place
Providence, RI 02903
Telephone: 401-421-6487

The Rhode Island Lung Association is primarily an educational organization whose mission is the prevention and control of lung disease. Its resource materials include publications and audiovisual aids. Rhode Island Lung Association offers information and referral services to the public. It can also respond to requests for resource materials for public, professional and school educational programs.

- **Rhode Islanders Saving Energy**
280 Broadway
Providence, RI 02903
Telephone: 401-272-1040

R.I.S.E. offers a broad range of indoor air quality services to homeowners in Rhode Island. These include measuring indoor radon levels and suggesting remedial action, identifying materials containing asbestos and arranging to have a licensed asbestos abatement contractor remove deteriorating asbestos, testing for formaldehyde concentrations and determining appropriate ventilation requirements.

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