



## HOW-TO BOOKLET #3401 INDOOR AIR QUALITY



### TOOL & MATERIAL CHECKLIST

- Whole-House Fan
- Duct Tape
- Humidifier
- Air Cleaners
- Heat Recovery Ventilators
- Soffit and Roof Louver Vents
- Dehumidifier
- Range Hood
- Exhaust Fan

*Read This Entire How-To Booklet for Specific Tools and Materials Not Noted in the Basics Listed Above.*

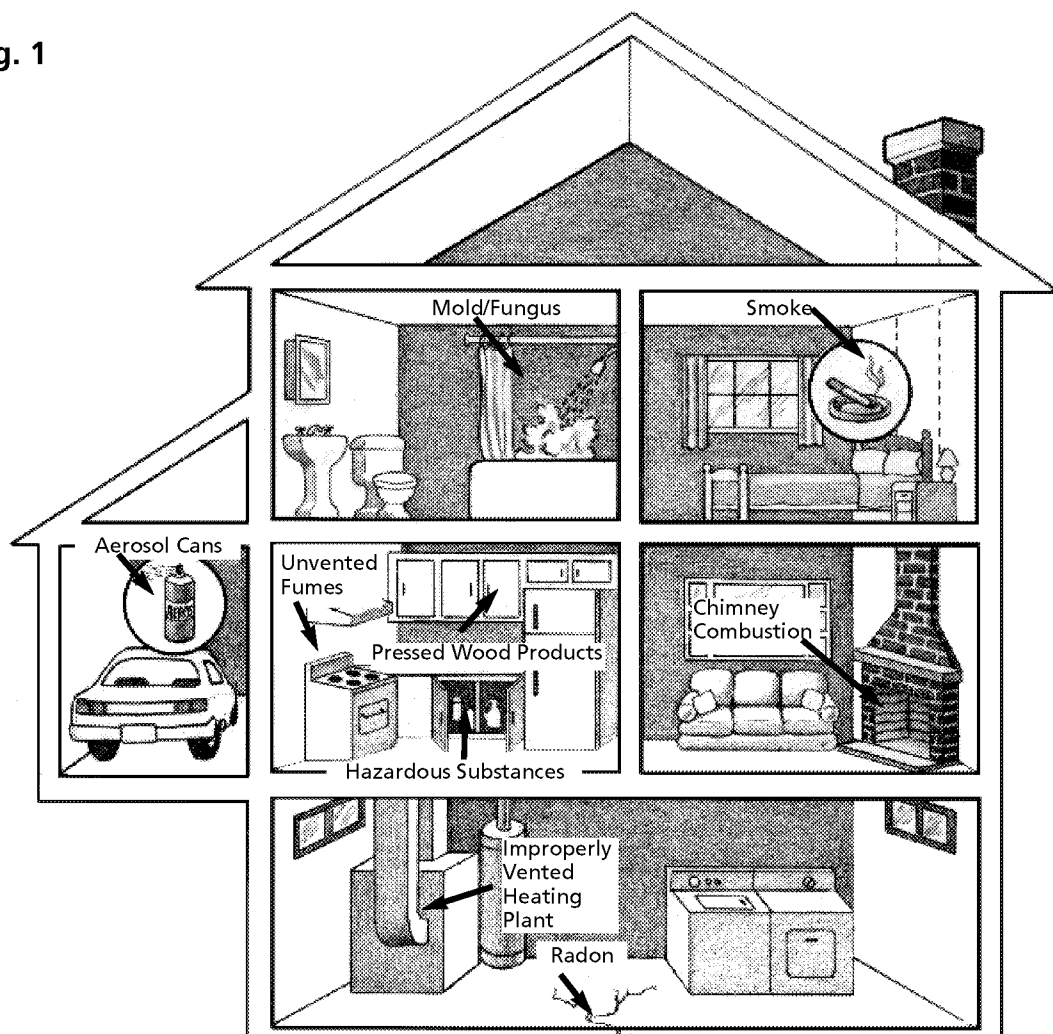
Studies have shown that the air in our homes can be even more polluted than the outdoor air in big cities. People spend a lot of time indoors and the quality of the indoor air can affect their health. Infants, young children and the elderly are shown to be the most susceptible to pollutants. People with chronic respiratory problems, cardiovascular illness, or immune system diseases are also more susceptible than others to pollutants.

Many factors determine whether pollutants in your home will affect your health. Factors include the presence, use, and condition of pollutant sources; the level of pollutants both indoors and out; the amount of ventilation in your home; and your overall health. Keep in mind that some people are more sensitive to air pollutants than others, which explains why not everyone in a household will always be bothered by poor air quality.

Most homes have more than one source of indoor air pollution. For example, pollutants come from tobacco smoke, building materials, decorating products, home furnishings, activities such as cooking and cleaning, as well as house heating and cooling cycles (**Fig. 1**).

The Assistance of Green Seal, Washington, DC; The Healthy Home Institute, Bloomington, IN; and Linda Mason Hunter, Healthy Home Designs, Des Moines, IA, is gratefully acknowledged in reviewing the information in this booklet.

Fig. 1



Sources of indoor air pollution.

## POLLUTANT SOURCE CONTROL

The most effective way to improve indoor air quality is to eliminate individual sources of pollution or to reduce their emissions. In some cases, factors such as how old the source is and whether it is properly maintained are significant. An improperly adjusted gas stove, for example, can emit significantly more carbon monoxide than one that is in good repair.

Some sources, including building materials, pressed-wood furnishings, and products such as air fresheners, release pollutants more or less continuously. Other sources release pollutants intermittently: smoking; using unvented or malfunctioning stoves, furnaces, or space heaters; solvents; paint strippers; pesticides; and cleaning products used in housekeeping. As a normal by-product of metabolism, people and pets release a number of pollutants as well as significant levels of moisture into the air. High concentrations of some of these pollutants can remain in the air for long periods following some of these activities.

## HOME VENTILATION

It is sometimes too expensive or impractical to remove the source of indoor air pollutants. When sources cannot be removed, air and moisture movement in the home can help improve your indoor air quality.

Every house needs a breath of fresh air—at the right time and in the right place. If too little outdoor air enters a home, pollutants can accumulate to levels that pose health and discomfort problems. Many homes that are designed and constructed to minimize the amount of outside air that can "leak" into the home may have higher pollutant levels than other homes. In addition, weather conditions can drastically reduce the amount of outside air that enters a home, so pollutants can build up even in homes that are normally considered "leaky."

There are three basic ways that air enters and exits a house:

- 🏠 Infiltration. Air flows through unintended passages such as the joints and connections of building materials. Cracks in window and

door frames caused by house-settling lets air in and out. Air may also rise up from crawlspace below a home.

- 🏠 Natural ventilation. The intended air circulation through opened windows and doors.
- 🏠 Mechanical ventilation. Air can be moved about intentionally by a fan vented either outside for exhaust or vented to pull in fresh air. Larger air-handling systems can remove polluted air from the entire home while introducing fresh outside air.

**Air Exchange Rate.** The air exchange rate is the rate that outside air displaces indoor air per hour in a structure. Without a sufficient air exchange rate, pollutants can accumulate. In newer, "tightly sealed" homes the air exchange rate ranges from 0.3 to 1.0 air changes per hour. An older home may have a rate as high as 2.0 air changes per hour. Be aware that by simply exchanging all the air in a house (1.0 air exchange rate), all the pollutants may not be removed in one hour. An air exchange rate of 1.0 will replace all the air but pollutants are emitted by carpets, drapes, pressed-woods, and other objects that are constantly and slowly being emitted. Therefore, a home must ventilate constantly to slowly dilute and remove the air pollutants.

**Improving Ventilation.** Increasingly higher energy costs have spurred new construction methods and materials for tighter houses. Ventilation is more important than ever before in these homes. Well-ventilated houses are more comfortable in both winter and summer, and pollutants that cause health problems are vented out.

In many homes, infiltration and natural ventilation may not provide enough fresh air so you will have to arrange for additional ventilation. Extra ventilation may be required to supply fresh air, reduce the relative humidity, or to provide combustion air for a fuel-burning appliance.

There are many symptoms of inadequate ventilation:

- 🏠 Condensation throughout the house on the inner surface of double pane windows, metal sashes, hinges and handles. (Condensation on

storm windows usually indicates a leaky window, not a tight house.)

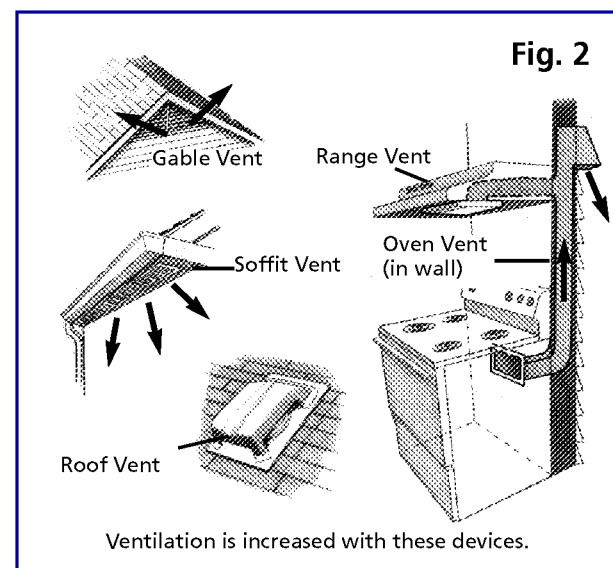
- 🏠 A stuffy atmosphere or lingering odors.
- 🏠 Odors from incomplete furnace combustion and smoke or poor draft in the furnace chimney.
- 🏠 Backdrafts and smoke emission from fireplaces.
- 🏠 A persistent light nausea, headaches, or chronic eye or respiratory irritation with hypersensitive people. Virtually any health complaint is possible if your house air is polluted.

If you have any of these symptoms, consider installing one or more of the following to improve living space ventilation:

- 🏠 Exhaust fans in the kitchen and in windowless bathrooms to help remove pollutants.
- 🏠 A mechanical system specifically designed to ventilate the living space (such as a heat recovery ventilator).

To improve attic and crawlspace ventilation install:

- 🏠 Soffit vents, roof vents (electric vents available), or gable vents to prevent heat buildup during summer, and moisture accumulation during winter (Fig. 2).
- 🏠 Vents at opposite corners of a crawlspace.



## HUMIDITY PROBLEMS

Making a house as tight as possible can increase the humidity inside in winter, especially in northern climates. Less moisture exits the house when all the windows are shut tight. Considerable amounts of moisture are produced as a result of normal household activities like cooking and bathing. With less cold, dry air flowing through the house from the outside, this moisture tends to build up indoors and raise the humidity. Indoor humidity should stay at a comfortable level regardless of the changing outside temperatures.

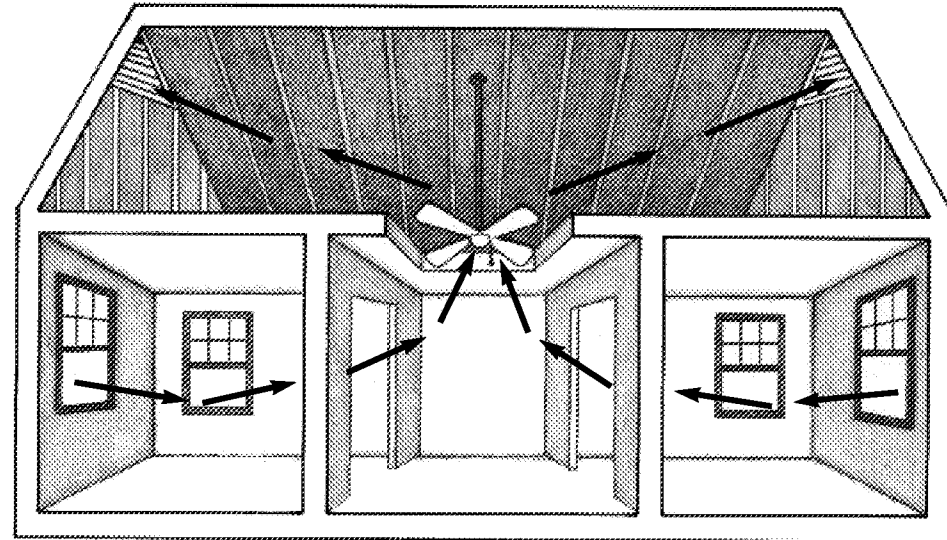
**Decreasing Humidity.** Moisture isn't a pollutant, but too much humidity can easily lead to air pollution problems. Take, for example, mold and mildew—more people are allergic to them than to anything else. These proliferate at higher humidities. Also, formaldehydes in some building materials out-gas faster at higher humidities.

Most homeowners who have gone to some trouble to reduce their heating bills are reluctant to bring in cold air to avoid moisture and condensation problems. Generally, the best first step is to cut back on moisture production. A dehumidifier will reduce the humidity inside the house.

Other ways of reducing the relative humidity in your home are:

- 🏠 Avoid hang-drying your clothing and venting clothes dryers indoors.
- 🏠 Be sure that your basement is properly drained and damp-proofed. Keep gutters and downspouts flowing properly and make certain the outside ground slopes away from basement walls.
- 🏠 Cover earth floors in crawlspaces or basements with polyethylene sheeting. Damp ground or foundations can operate like a powerful humidifier. This is often a problem in crawlspaces in new houses.
- 🏠 Watch the amount of moisture you produce. Plants, bathing, and cooking also produce large amounts of water vapor.

Fig. 3



A whole-house fan will increase the air exchange rate.

**Adding Humidity.** Your home may suffer from a lack of humidity in the winter. Cold, outside air combined with the heat from heating sources creates low humidity. Both furnace-attached and portable type humidifiers are excellent for adding moisture to dry air to relieve the physical discomforts of dry nose, throat, lips and skin. If these devices are not properly operated, they can produce excessive moisture and encourage the growth of biological organisms in the home. (See How-To Booklet #3406.)

## REPLACING INDOOR AIR

It's possible to use your fireplace chimney as a natural exhaust or air-entrance by opening the damper slightly. In winter, air escapes up the chimney and is replaced in the house by drier outside air. In summer, if the home is air conditioned, outside air can come down the chimney. Adjust the damper to ensure that too much air does not escape, or enter the home. Keep the chimney clean to maximize air movement.

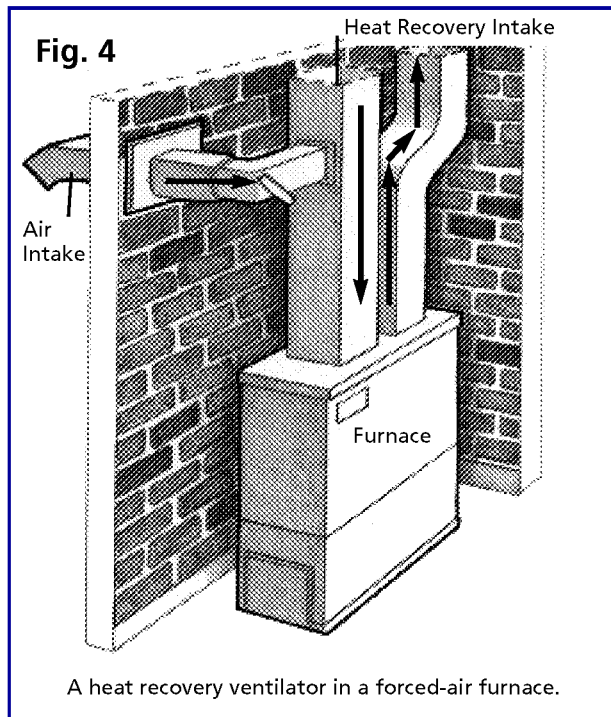
In addition to kitchen and bathroom fans, there are other mechanical devices that bring in fresh air and expel stale or humid air. You can save on your air conditioning bill (and greatly reduce frost build-up on your attic rafters and sheathing in winter) by installing a wind activated turbine or electric attic fan on the roof. To exhaust warm, humid, summer air, (as well as irritating pollutants) quickly from your home, install a whole-house fan (**Fig. 3**). Some of these methods will ventilate the whole house, and others only the attic space. Be sure your choice of ventilation will serve the intended purpose.

**Sizing Electric Fans.** For the proper size electric fan, multiply the square footage of the attic by 0.7 to determine the cubic feet per minute (CFM) rating needed. If your roof is dark in color add 15 percent to this figure. If you plan on using turbine powered fans, you will require two unless your attic has more than 1,200 square feet, in which case you will need three. To size whole-house fans correctly, multiply the square footage of the living



area by 3 for the minimum CFM rating. Many building codes suggest 50 CFM for bathrooms that have no window. Considering that most bathroom windows are kept shut in winter, install a fan there.

**Heat Recovery Ventilator.** Another device to increase the mechanical ventilation rate is a heat recovery ventilator. This device is also called an air-to-air heat exchanger. It can be installed in windows or as part of a central air system to increase ventilation by drawing outside air into the home. It also conserves energy by recovering the heat from air that is exhausted to the outdoors. Heat recovery ventilators (HRV) are most easily installed in central air systems in new homes or during extensive remodeling; window units can be installed in existing homes (Fig. 4).



## USING AIR CLEANERS

Sometimes, there's no way around it—you're going to get air pollutants in your home. Air cleaners can help this problem. They are filters that capture airborne contaminants and remove them from the air. Air cleaners can be used to simply keep equipment clean. Furnace filters, for example, serve mostly to keep large particles (including bugs, hairs, and lint balls) out of home heating, ventilating, and air conditioning (HVAC) systems. Air cleaners can also be used to reduce surface grime. Reducing the quantity of particles in the air, including grease particles, makes it easier to keep walls, floors, and other surfaces clean. Some perform odor control, which is especially useful to homeowners who smoke or who engage in arts, crafts, or refinishing hobbies. Many air cleaners capture the kinds of plant pollens, spores, and dusts responsible for allergies. The more efficient filters reduce the particulate allergens present in tobacco smoke.

Several types of air cleaners are available. The most common are:

- 🏠 Filters that use a filtration medium (pleated fabric), similar to a typical furnace filter. There are some extended surface filters which have additional filter media for greater filtering action. There are filters available that contain small amounts of carbon but most residential air cleaner filters don't contain enough carbon to be very effective.
- 🏠 Electronic air cleaners, such as electrostatic precipitators, trap charged particles using an electrical field.
- 🏠 "Hybrid" devices contain two or more of the particle removal devices discussed above.

Some air cleaners are designed to fit in central heating/air cooling duct systems, replacing the conventional filters. Others are built as stand-alone in-room units or table-top models.

The effectiveness of any air cleaner depends on its efficiency in removing contaminants and on the amount of air it can treat. Air cleaner manufacturers furnish information on the amount of air that can be treated by a unit in a given time (termed as "rated flow") and on the efficiency of that treatment. With in-room units, the percentage of the room air treated depends on room size and location of the device. Air cleaners generally won't remove gaseous pollutants, such as radon or tobacco smoke. They don't remove moisture from the air or introduce oxygen, so they are not a substitute for ventilation.

Maintenance of air cleaners consists mainly of changing or cleaning filters or collection plates, and checking to be sure the unit is functioning properly.