

HOMEOWNER'S GUIDE TO VENTILATION



NYSERDA

**New York State
Energy Research and
Development Authority**



Good ventilation is important

Because people spend about 90% of their time inside, indoor air pollution can actually be a bigger health risk than pollution in the air outside, even in crowded cities and industrial areas.

This booklet will introduce you to the basics of home ventilation. Once you understand them, you'll know why ventilation is important, how your home is ventilated, and what you can do to improve it.

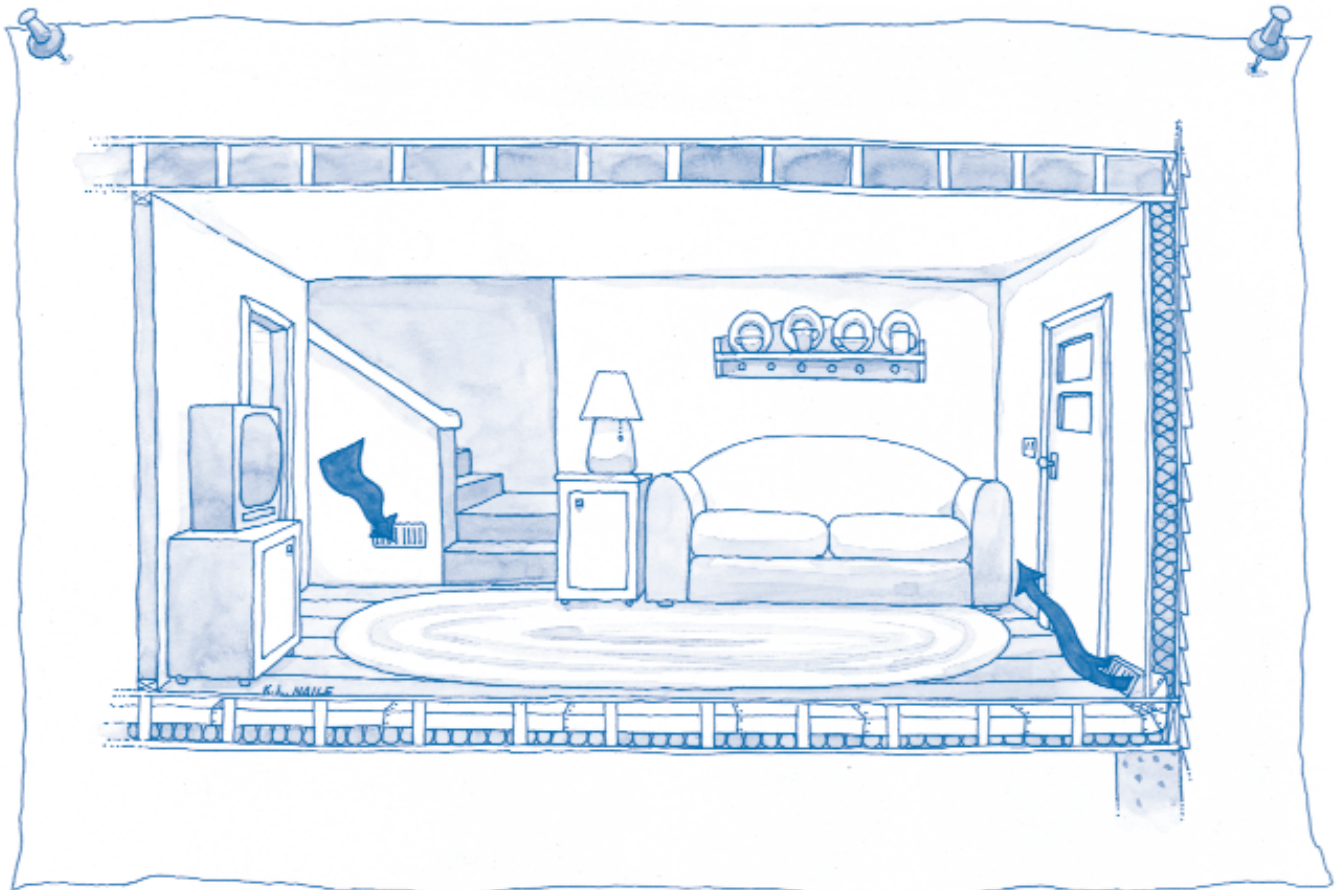
Whether you're buying a new home or taking care of the one you're in now, good ventilation is important because it helps protect your health *and* your home. Good ventilation is as critical to your comfort and safety as a reliable heating system, a smoke alarm, or a dry basement.

Your health

Good ventilation protects you, your family, and your guests from unpleasant odors, irritating pollutants, and potentially dangerous gases like carbon monoxide and radon. Well-planned ventilation also prevents the growth of mold and mildew, which can cause or aggravate allergic reactions and lung problems such as asthma.

Your home

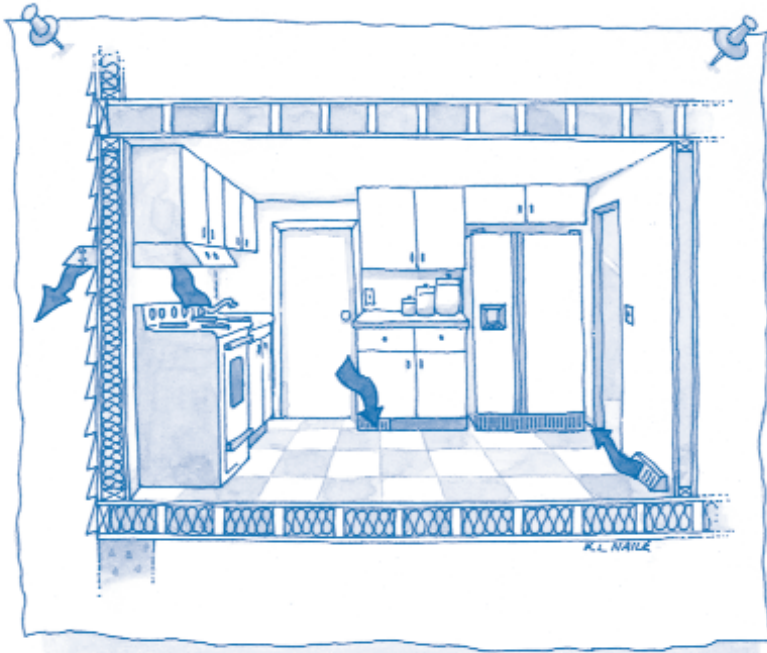
Good ventilation protects your home from damage by eliminating excess moisture from the air. Too much moisture rots window sills and attic eaves, peels paint, and invites insect infestation. Damp insulation in walls and ceilings means lost heat, higher fuel bills, and destructive mold growth. Carpeting, wallpaper, electronic equipment, and furniture all can be damaged by excess moisture.



Ventilation means fresh air

Ventilation *supplies* fresh air to your home and *dilutes* or *removes* stale air. There are many ways this can happen. For example, opening windows to air out your home can supply fresh outdoor air that dilutes stale indoor air. Turning on the fan over the kitchen range or in the bathroom removes odors and moisture. Other common examples of home ventilation include chimneys, which remove combustion gases, and clothes dryer fans, which exhaust warm, moist air and chemicals from laundry soaps.

You may already know if you have a ventilation problem. Do you notice the sour smell of garbage from a trash can; a musty, gym-like smell coming from the bedroom walls; or mold or mildew in closets, or on ceilings or exterior walls? Is there condensation on the inside of your windows? Are your eyes irritated when you're at home? These conditions may be signs of poor ventilation.



Fixing your home's ventilation

While just opening a window may seem like an easy, low-cost way to provide fresh air, you will need a fan to make sure this air goes where it is needed. Good ventilation can be achieved at a reasonable cost. Depending on your home's design and location and the type of system you select, a ventilation system may cost in the range of \$500 to \$1,500, including installation. The cost to operate a typical ventilation system will be approximately \$100 to \$200 per year, depending on your home's location, the type of system used, and how your home was built. With new construction, operating costs can be minimized by building a well-insulated, tightly sealed home with a well-designed ventilation system. These same features in existing homes can *reduce* operating costs because many homes are leakier than they need to be. Some ventilation systems include energy-recovery features. While more expensive to install, in time they can pay for themselves in energy savings.

When gas and oil were cheap, most people didn't pay attention to how leaky their homes were; they just turned the thermostat up in the winter and down in the summer. Buildings often had 3 to 5 times more ventilation than they needed. With rising prices that resulted from the 1970s oil crises, people looked for ways to reduce the cost of heating and cooling their homes. The building industry responded by developing and installing measures such as better windows, more insulation, high-efficiency furnaces and air conditioners, and limiting the amount of outdoor air leaking into homes. Many of the problems discussed in this guide soon began to appear. Although "tight" homes were part of the problem, they were also part of the solution.

Well-sealed homes are less expensive to heat and ventilate because you can control how much outdoor air comes in and where it goes. The answer, then, is to "build tight and ventilate right."

Remember: every pollutant has a source. It may be as simple as an overflowing garbage can or as complicated as mold growing inside walls. Whatever the case, you must identify the source before you can solve the problem. One of the easiest ways to improve indoor air quality is to remove or avoid using common sources of moisture, odors, and gases. Some examples include: not storing firewood in the house, taking out the garbage and then washing the can, and using milder cleaners or water-based paints to avoid chemical odors. Although only a temporary solution, cleaning surface mold and mildew freshens the air. Be aware, however, that some molds can be dangerous when released.

Ventilation basics

There are two basic approaches to ventilating your home:

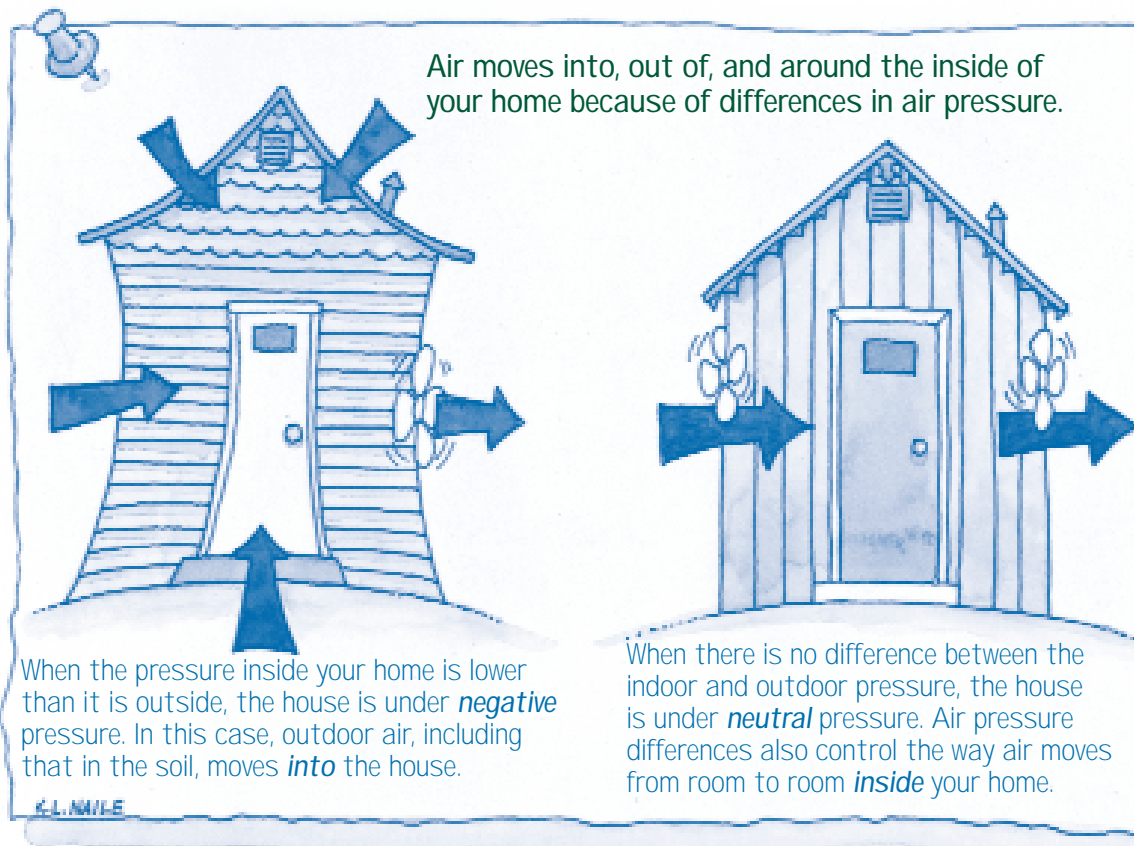
- Spot ventilation for localized pollution sources
- General ventilation to dilute pollutants from sources that exist in many locations or move from place to place.

General ventilation can be provided in two ways: exhaust-only, and supply-and-exhaust.

Whichever method you choose, spot ventilation is also needed in those places where strong sources are located, such as bathrooms and kitchens.

Spot ventilation

Spot ventilation uses exhaust fans to collect and remove pollutants before they spread throughout your home. The exhaust fan is generally turned on only when the source is producing pollutants. Bathrooms, kitchens, and laundry rooms all contain obvious sources of moisture and odors. Spot ventilation may also be appropriate for home offices, hobby rooms, or workshops.



General ventilation

General ventilation fans run all the time to control pollutants from sources that can't be spot-ventilated. For example, people and pets constantly release flakes of skin, bacteria, viruses, moisture, body odors, and digestive gases. Some sources, including carpets, furniture, and drapes, all of which release fabric fibers and gases such as formaldehyde, are too large or spread out to be spot-ventilated.

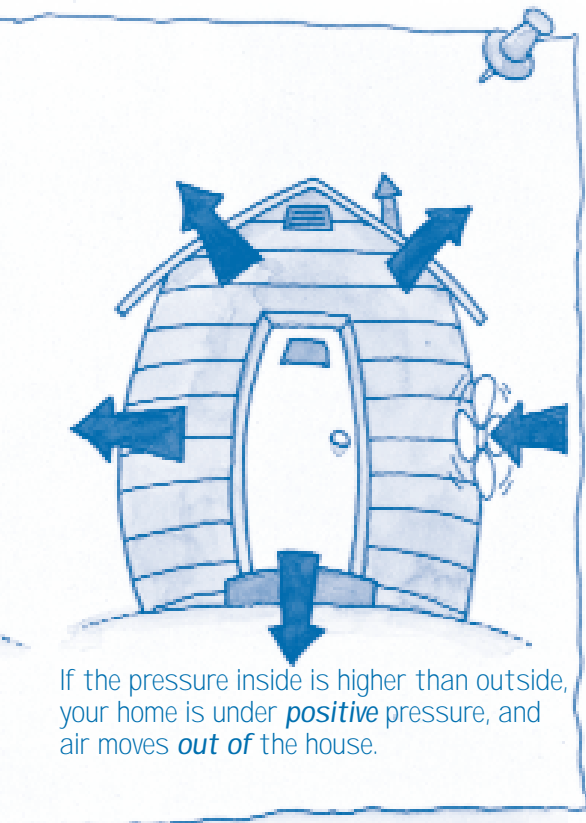
General ventilation mixes fresh outdoor air with stale indoor air to lower the concentration of pollutants (*dilution*). Fresh air is provided by fans blowing outdoor air into the house, which forces air out through cracks and openings (*pressurizing*), or by exhausting air from the house, which then draws fresh air inside (*depressurizing*).

Exhaust-only

With *exhaust-only ventilation*, exhaust fans pull stale air out of your home while drawing fresh air in through cracks, windows, or fresh air intakes. If you use this strategy, your home will be *depressurized*. Exhaust-only ventilation is a good choice for homes that do not have existing ductwork to distribute heated or cooled air. However, if there is radon in the soil around the house, this method can increase indoor radon levels. (See "radon" section on page 7.)

Supply-and-exhaust

With *supply-and-exhaust ventilation*, exhaust fans pull stale air out of the house while intake fans blow in fresh air. This system is more complex than exhaust-only, but may ensure the best flow of fresh air into your home. Outdoor air is drawn in by fans and delivered to rooms through heating and cooling ducts. Supply-and-exhaust ventilation is a good choice for homes with heating or cooling ducts because it's an inexpensive way of providing fresh air. Some homes may benefit from energy-recovery ventilation, which warms (or cools) incoming air with outgoing exhaust air.



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Air pressure differences are caused by such things as wind, temperature differences, and fans. For example, air moves into a home on the upwind side and out of a home on the downwind side because of pressure differences; heated air from a boiler or fireplace goes up a chimney because of temperature differences; exhaust fans remove cooking odors by making the pressure in the kitchen lower than the air pressure outside. Air always moves from higher- to lower-pressure areas. Understanding how air moves inside your home can help you avoid or fix such ventilation-related problems as excess moisture, backdrafting, and radon.

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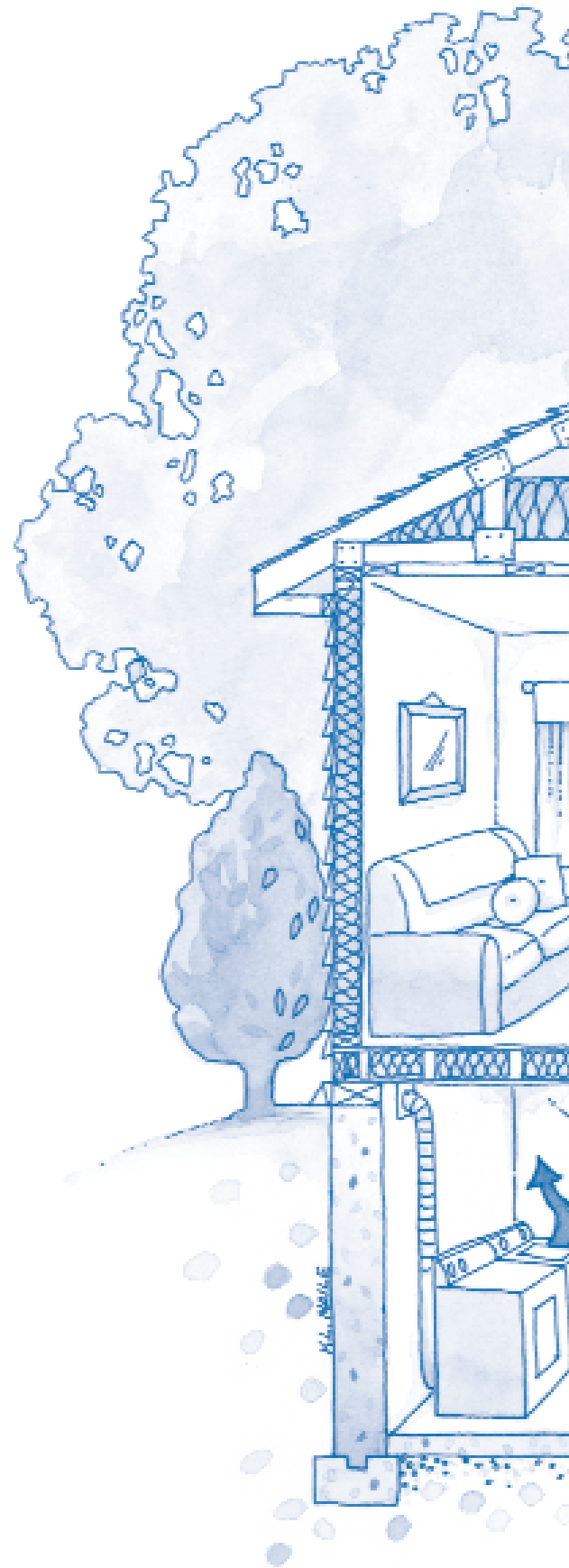
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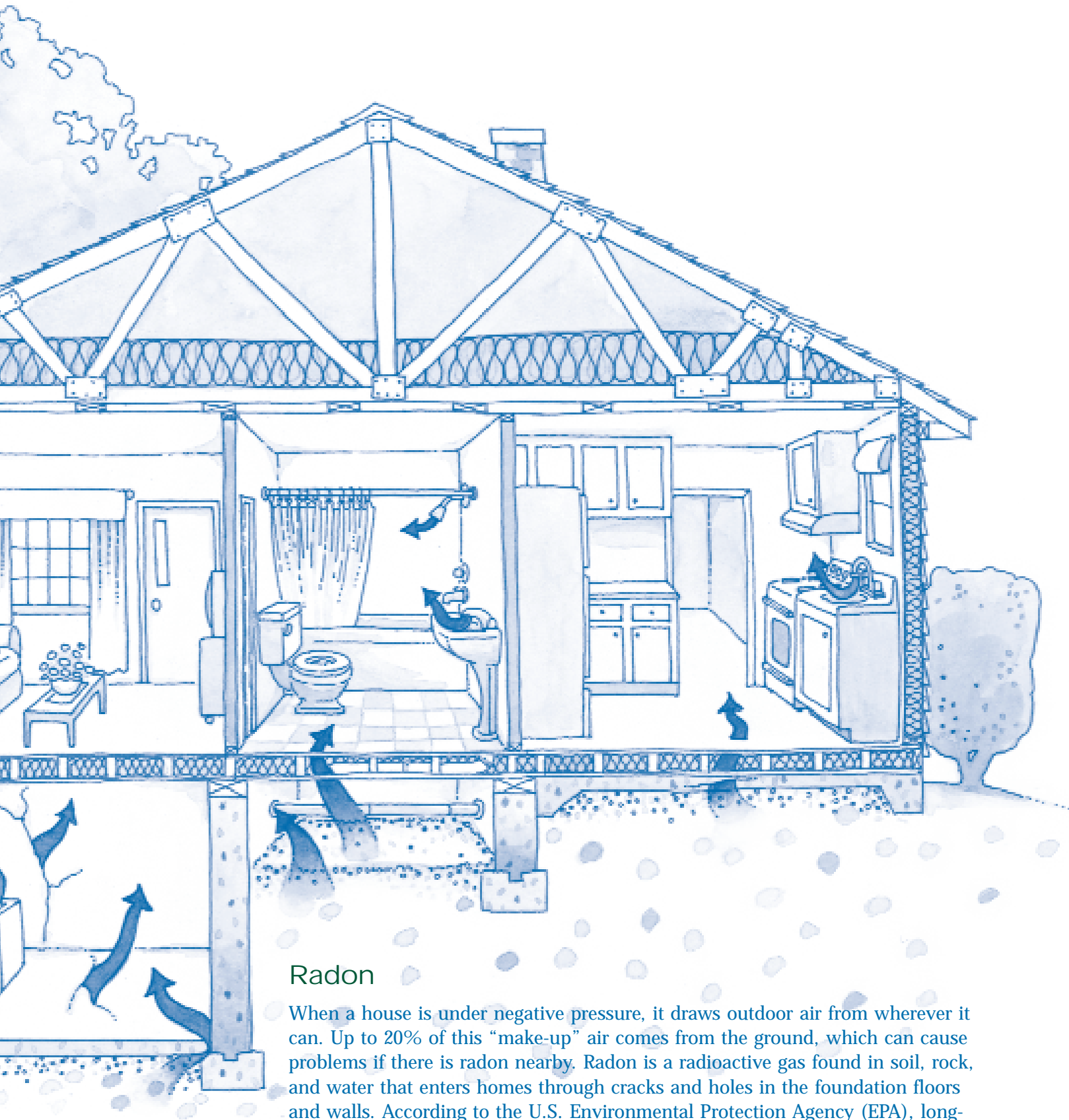
There are certain circumstances when operating a house under negative pressure can cause serious problems for your family:

Backdrafting

Furnaces, hot water heaters, and fireplaces need air to burn fuel and exhaust combustion gases up the chimney. A house under enough negative pressure can pull air down the chimney, drawing combustion gases such as carbon monoxide into the house. This is called “backdrafting” and is a very serious condition that can quickly cause severe injury or even death. Before installing a ventilation system, you should have your home checked to make sure there is adequate make-up air for the fuel-burning equipment. After the system has been installed, or after any major structural changes have been made, it is very important to recheck for both backdrafting and radon. (See “Selecting a contractor” section on page 10.)

Moisture problems occur when warm, moist air hits cold surfaces, such as walls, windows, attic ceilings, air-conditioning ducts, and plumbing. For this reason, it can be helpful to keep the pressure in your house **slightly negative** in the **heating season**, pulling dry **outdoor** air through the outside walls into your home. When your home is **air conditioned**, it is better to keep the pressure **slightly positive**, pushing dry **indoor** air into the outside walls.





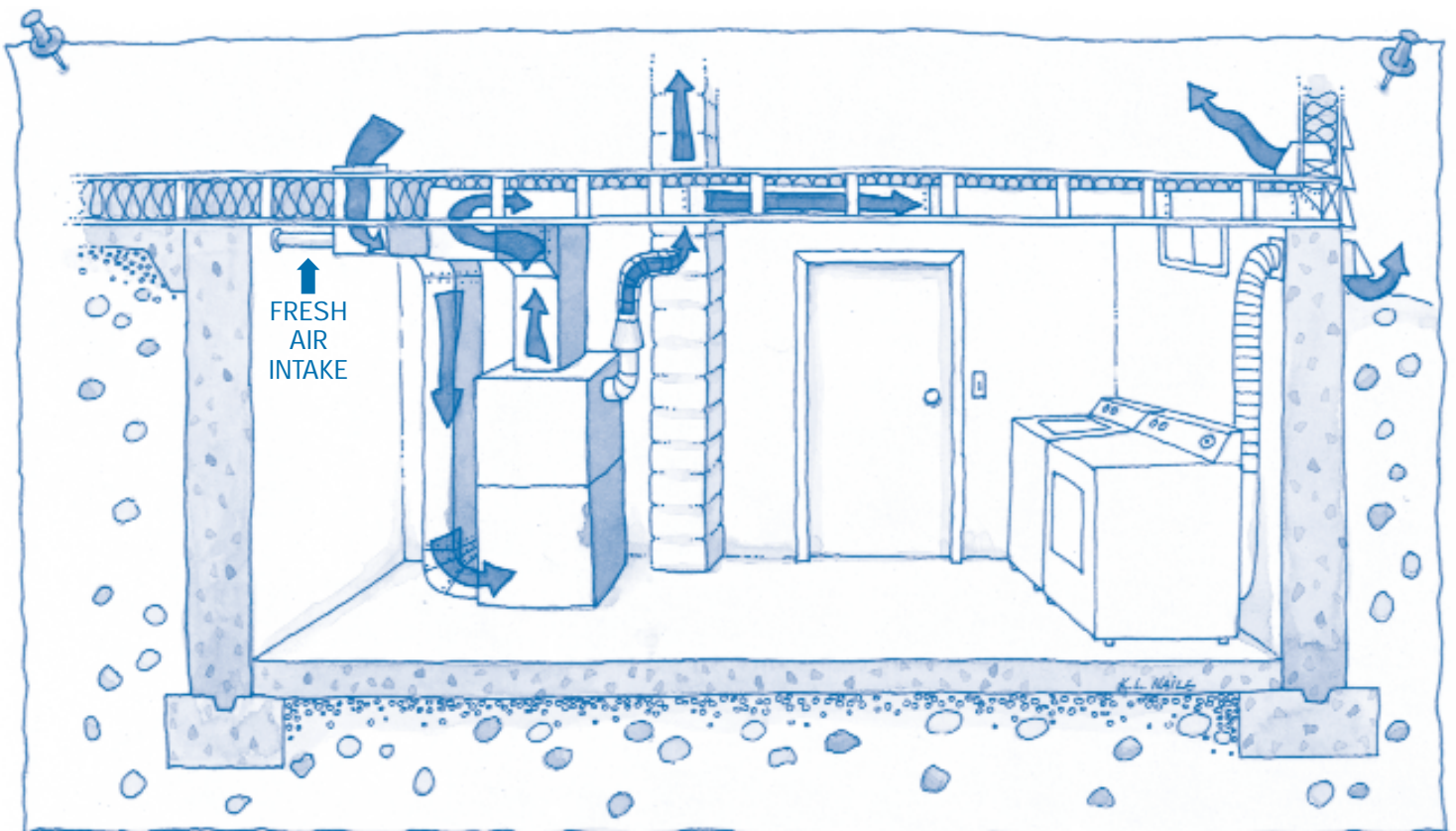
Radon

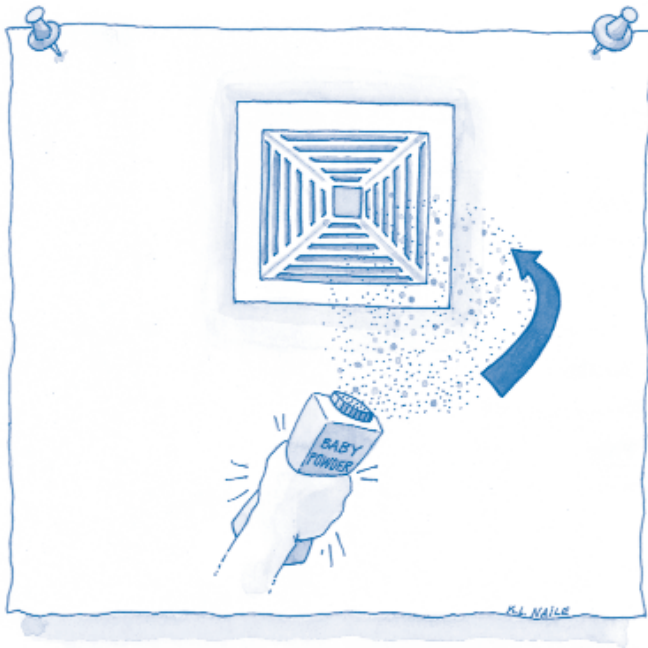
When a house is under negative pressure, it draws outdoor air from wherever it can. Up to 20% of this “make-up” air comes from the ground, which can cause problems if there is radon nearby. Radon is a radioactive gas found in soil, rock, and water that enters homes through cracks and holes in the foundation floors and walls. According to the U.S. Environmental Protection Agency (EPA), long-term exposure to elevated levels of radon causes between 7,000 and 30,000 lung cancer deaths each year. The only way to know whether your home has a radon problem is to test it. Your state radon contact or EPA can provide you with free information on radon, including lists of people trained to test and fix homes with elevated radon levels. (See “For more information” section on page 11.)

Looking at your home

Here are some questions to help you evaluate your home's ventilation system. If you answer "no" to any of these questions, you should consider making some changes.

- Do you have both continuous general ventilation and as-needed spot ventilation?
- Is your home free of lingering odors?
- Are your windows free of condensation?
- Is the dryer vented to the outdoors?
- Is each fuel-burning device, such as the woodstove, furnace, and hot water heater, vented separately?
- Are the exhaust ducts in unheated spaces insulated?
- Is the exhaust fan over the kitchen stove vented to the outdoors?
- Is there an exhaust fan in each bathroom?
- Has your home been tested for radon? If so, were the radon levels high?
- Are outdoor air inlets located away from pollutant sources?
- Is each exhaust fan working and vented to the outdoors (not to the attic, soffit, or crawlspace)?
- Is exhaust air condensation-free?



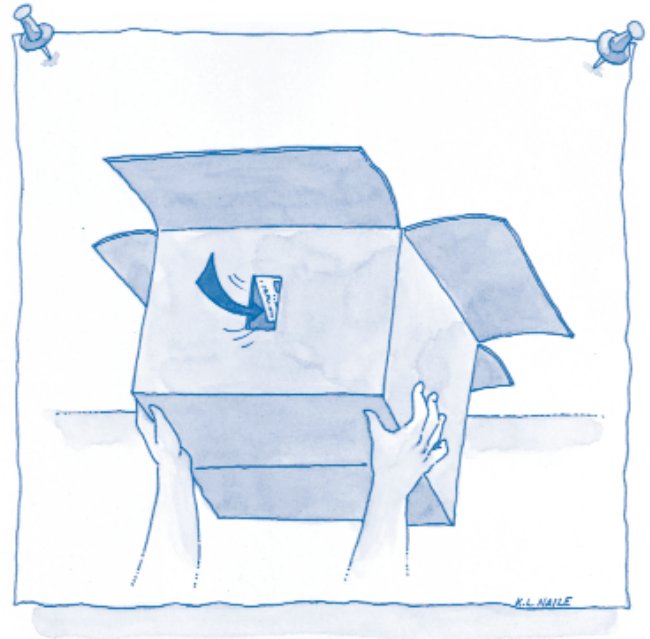


Checking your exhaust fans

Test #1

From six inches away, squeeze a cloud of baby powder from its container toward the intake grille of an operating exhaust fan. If the fan is working properly, the powder should be drawn into the grille. If it goes to the center of the grille and is blown back into the room, then the fan is blocked; if the powder simply hangs in the air, the fan is not working.

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 You can check the air flow through exhaust fans with these two tests. The first tells *if* your fan is working; the second tells *how well* it's working.



Test #2

Find a cardboard box with an opening big enough to fit over the exhaust fan grille. If the fan is mounted in the wall, cut a hole slightly smaller than a credit card in the bottom of the box, or, if the fan is mounted on the ceiling, in the side of the box. Using any kind of tape, attach a credit card inside the box over the hole. Make sure the card can swing back and forth in the box. Turn the fan on and put the box over the exhaust grille. If the fan is working, the credit card will swing into the box. The greater the air flow, the more the credit card will swing open. If it swings open 1½ inches or more, the fan is moving at least 25 cubic feet of air per minute, which is a reasonable amount for a bathroom. If the card swings open less than 1½ inches, you should consider repairing or replacing the exhaust fan. (Tip: use a pencil instead of a ruler to measure how far the card swings open, because a ruler will block the air flow.)

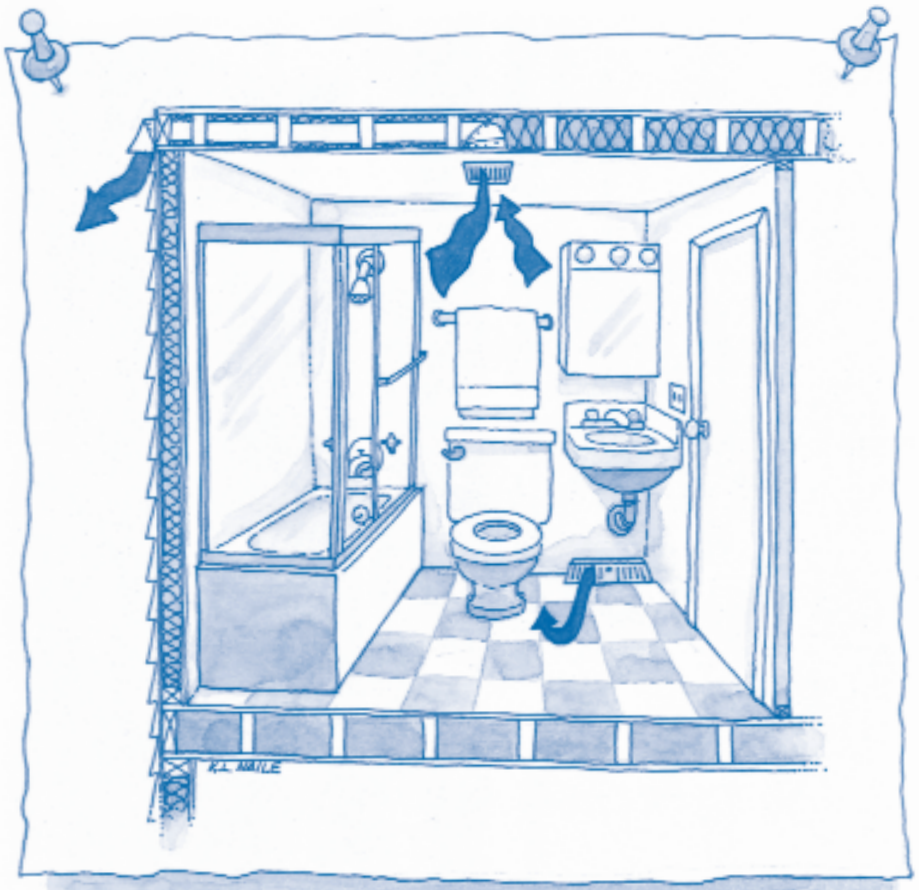
Selecting a contractor

When you talk to contractors, it's important to determine how well they understand ventilation basics and systems. Here are some questions to ask them:

- What kind of ventilation training do you have?
- What courses have you taken?
- Who provided the training and are they reputable?
- Who are your references?
- Do you have any photographs to show me of ventilation systems you've installed?
- What tests will you perform to determine problems with the current equipment and the building itself?
- What will the new system involve?
- How long will it take you to install the system?
- Exactly how will it work?
- How will my heating/cooling bills be affected?
- How much maintenance will this system require?

Whether designing a new home or improving the ventilation in your existing home, you will probably need the services of an experienced contractor. If you need information or help with the combustion equipment in the house, the most knowledgeable people are gas utility technicians, heating contractors, and home inspection professionals. If you need to know how the combustion equipment in your home affects other equipment and the house itself, the people to talk to are usually weatherization contractors, home inspection professionals, or EPA-listed radon mitigation contractors.

As always, when hiring a building contractor, be sure to get a complete cost estimate for the time and work involved. You should also get guarantees about the quality of work and materials, and assurance that you can transfer the guarantees to a new owner. Finally, the contractor should provide proof of liability insurance.



For more information

Home ventilation is important! If you have questions, contact...

EPA Indoor Air Quality (IAQ) Information Clearinghouse: 800-438-4318

General IAQ
State IAQ contacts
Environmental tobacco smoke
Radon

National Safety Commission Radon Helpline: 800-55-RADON

Radon, including EPA lists of radon mitigation and testing contractors

EPA Web Sites:

<http://www.epa.gov> (general)
<http://www.epa.gov/iaq>
<http://www.epa.gov/radonpro> (EPA-listed testing and mitigation contractors)

EPA Regional Radon Training Centers:

Eastern: 908-445-2582 Western: 303-491-7742
Midwestern: 612-624-8747 Southern: 205-844-4370

Radon, including EPA-listed testing and mitigation contractors
General IAQ

U.S. Consumer Product Safety Commission: 800-638-2772, ext. 555, publications; ext. 569, IAQ publications; fax-on-demand: 301-504-0051; <http://www.cpsc.gov>

Carbon monoxide
Formaldehyde
Lead

American Lung Association: 800-LUNG-USA

General IAQ
Biological agents
Environmental tobacco smoke
Asbestos
Radon
Combustion pollutants
Formaldehyde

**State and local health departments:
see your local phone directory**

**State and local builders' associations:
see your local phone directory**

**County Cooperative Extension Services:
see your local phone directory**

**New York State
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