HOW-TO BOOKLET #3403

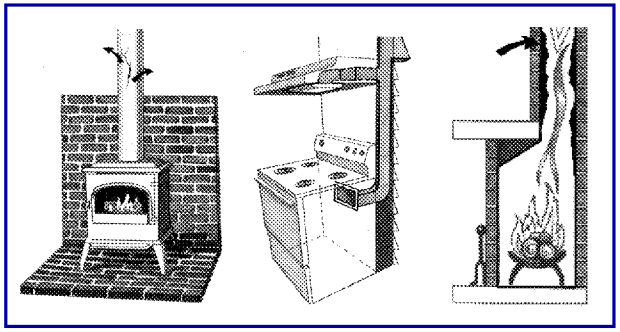
COMBUSTION POLLUTANTS

TOOL & MATERIAL CHECKLIST

- ❑ Carbon Monoxide Detector
- ❑ Outside Vents
- ❑ Creosote Remover
- ❑ Appliance Owner's Manual
- ❑ Appliance Vents
- ❑ Exhaust Fan
- ❑ Appliance Filters
- ❑ Smoke Detector
- ❑ Chimney Liner

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

Most homes have more than one source of indoor air pollution. Pollutants come from tobacco smoke, building materials, decorating products, home furnishings, and everyday activities such as cooking, cleaning, and heating and cooling cycles. Living in areas with high levels of outdoor pollutants will result in high indoor levels. Combustion pollutants are one category of indoor air pollutants in the home.



WHAT ARE COMBUSTION POLLUTANTS

Combustion pollutants are gases or particles that come from burning fuels in appliances. The common fuels burned are natural or liquefied petroleum (LP) gas, fuel oil, kerosene, wood, and coal. The types and amounts of pollutants produced in your home depend on the appliances you use and how well they're installed, maintained, and vented. Burning candles, incense, and cigarettes also releases combustion pollutants.

The ill effects felt by people from combustion pollutants include headaches and breathing difficulties and can eventually lead to death. Some reactions are felt immediately after exposure; others are delayed. A person's reaction to these impurities depends on his age, physical condition, and sensitivity.

Some of the combustion pollutants produced from burning fuels are nitrogen dioxide, sulfur dioxide, unburned hydrocarbons, aldehydes, and particles. Of all of the combustion pollutants, the most dangerous is carbon monoxide.

Carbon Monoxide. Carbon monoxide (CO) is an odorless, colorless, tasteless, toxic gas produced by any kind of combustion. It is a leading cause of fatal poisonings in America. Once inside your system, CO deprives tissues of life-sustaining oxygen. At low levels of inhalation, CO exposure mimics flu symptoms including headaches, nausea, diarrhea, dizziness, and fatigue. At higher levels, it can cause brain damage and death.

Any home with a furnace, water heater, fireplace, space heater, or appliance that operates on a flammable fuel is a candidate for deadly carbon monoxide build up. The problem can be caused by:

- Inadequate venting of appliances
- Cracked furnace heat exchangers
- Air pressure changes inside your home that send flue gases back down your chimney
- Improper installation, maintenance, and use of appliances
- Equipment failure

Carbon monoxide poisoning deaths also have been caused by using barbecues in homes and by operating motor vehicles in attached garages.

CO Detectors. Install a carbon monoxide detector in your home. Just like smoke detectors, these devices use an alarm that sounds when a certain level of carbon monoxide is present. The EPA now recommends installing a CO detector in every home. Several types of detectors are available at local home centers **(Fig. 1)**. Some models are available that are both smoke and carbon monoxide detectors.

Carbon monoxide detectors must be properly installed following the manufacturer's directions to offer maximum protection. They must also be properly located. Install the CO detector as high as possible on a wall or on a ceiling above an appliance. This will provide the earliest possible warning of a CO hazard from this source. If more than one appliance is located in the same room, one detector centrally located on the ceiling between the appliances will provide sufficient warning.

Fig. 1

A typical carbon monoxide detector.

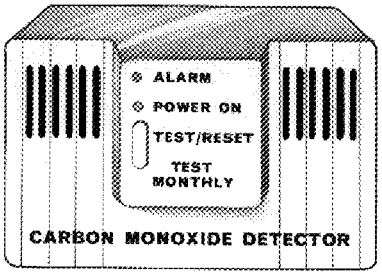
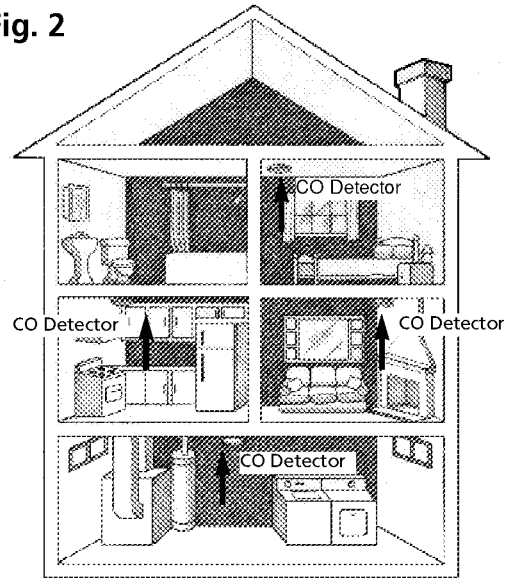


Fig. 2



Major sources of potential carbon monoxide build-up. Locate detectors as high as possible, on wall or ceiling.

Locate other CO detectors in the living spaces, on or near the ceiling in the sleeping areas, just outside individual bedrooms **(Fig. 2)**.

Respirable Particles. Combustion particles are another pollutant that can contribute to eye, nose, throat, and lung irritation. Tobacco smoke is a leading contributor to particle air pollution in the home. Despite growing recognition that smoking causes health problems, many people continue to smoke. Smokers not only endanger themselves, but others as well, through "secondhand smoke"—the smoke a person inhales from someone else's cigarette, cigar, or pipe. Smoke emits carbon monoxide, formaldehyde, and many other gases and particles, several of which are known to cause cancer.

The only method of reducing exposure to environmental tobacco smoke is to give up smoking and discourage smoking in your home. Ask smokers to smoke outdoors. If this isn't possible, confine cigarette smoke to one room, use a properly sized air filter, open a window, or use an exhaust fan. Ventilation will reduce, but not eliminate, exposure to environmental tobacco smoke.

Because smoking produces such large amounts of pollutants, ventilation can't remove them from the air in your home as quickly as they build up. Further, the large increases in ventilation needed to significantly reduce exposure to environmental tobacco smoke will boost energy costs. In short, don't smoke.

REDUCE EXPOSURE TO POLLUTANTS

You can reduce the level of combustion pollutants in your home by following a few guidelines. Proper selection, installation, inspection, maintenance, and use of your appliances are the keys to creating a safe home. Providing good ventilation in your home is equally important.

Proper Installation. Proper installation is critical to the safe operation of combustion appliances. New appliances have installation instructions which must be followed exactly. The manufacturer's instructions provide all vent and combustion air requirements.

All heating appliances must be vented **(Fig. 3)**. Proper vent size is crucial. A vent too small leads to combustion products "back drafting" and spilling out of the appliance into the home. A vent too large can result in insufficient draft, which also creates combustion product spillage. Adequate combustion air must be provided to ensure complete combustion.

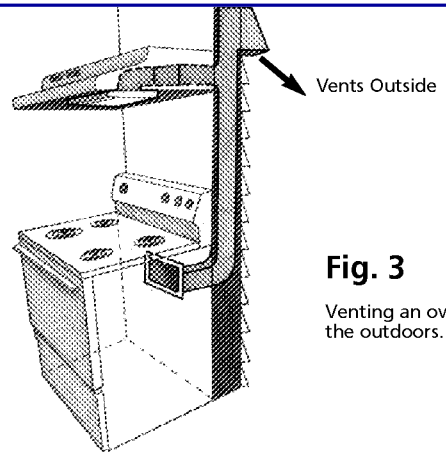


Fig. 3

Venting an oven to the outdoors.

If you see soot near your appliance installation, have the work checked. Soot is a product of incomplete combustion. It can clog the appliance heat exchanger and lead to carbon monoxide spillage. It also reduces the appliance's efficiency.

CAUTION: Don't use fuel-burning space heaters that are unvented. Many states have laws banning the use of unvented heating appliances.

Proper Maintenance. A poorly maintained appliance will create more combustion pollutants than normal. The home heating system includes sophisticated equipment that needs routine maintenance to ensure safe, efficient operation. Many new appliances have safety components attached that prevent operation if an unsafe condition exists. If an appliance stops operating, it may be that a safety device is triggered to prevent a dangerous condition. Don't operate an appliance that keeps shutting off. Call a service person.

Individual appliances should be serviced regularly. Proper service and maintenance requires special knowledge and equipment and is best done by a professional. Have all mechanical, electrical, and safety components checked annually for proper operation.

Chimney Safety. The chimney and vent components should be inspected for deterioration and blockage. Blocked, leaking, or damaged chimneys or flues can release harmful combustion gases and particles and even fatal concentrations of carbon monoxide **(Fig. 4)**. If your chimney has problems, check with your local home center or heating contractor about chimney configuration **(Fig. 5)**.

Chimneys in homes that have changed from oil to gas fuel are particularly susceptible to blockage. Oil residue on the interior surfaces of the chimney or vent can dry and flake off after conversion to gas. The resulting blockage can cause combustion products to be spilled into the home.

The formation of creosote in chimneys is an unavoidable by-product of burning wood. Creosote is a black tar-like, fluffy or glazed substance resulting from condensation of unburned wood gases. Creosote becomes dangerous when allowed to accumulate on the chimney interior. It can act as fuel for a chimney fire. Creosote build-up or leakage causes black stains on the outside of the chimney or flue. These stains can indicate pollutants leaking into the house **(Fig. 6)**.

Some woodstoves may require the flue to be cleaned monthly. Never wait more than one year between cleanings. Cleaning your own chimney is a difficult and dirty job. Let a commercial chimney sweep handle it. A qualified sweep has the knowledge and equipment to do the work properly.

PLAN FOR SAFETY

The table at right lists the typical combustion appliance problems that cause the release of pollutants in your home. Many of these problems are hard for a homeowner to identify. Hire a professional to handle some of the necessary maintenance.

NEGATIVE AIR PRESSURE

House depressurization has recently been named a leading cause of combustion pollutants inside the home. This negative air pressure can be caused by a combination of improper venting, excessive mechanical exhaust, leaky return air ducts, and an inadequate replacement air supply. Some houses have many or all of the following: kitchen and bath fans, range hoods, clothes dryers, central vacuum cleaners—all of which exhaust air and decrease the pressure in the house. As houses become tighter this problem increases.

Here's what happens: the burner of a fossil-fueled appliance is turned on. It begins drawing air to burn. The air needed can come from anywhere. Usually, it comes from the basement or living space. Replacement air comes in through a collection of structural cracks and openings. If there are fewer cracks because they've been sealed to save energy, the burner will draw air from another source. If the house is tight enough, the burner pulls air back down the chimney. The result is backdrafting.

In another scenario, a recently-started appliance (the furnace) pulls air from the flue of another appliance (the water heater). Consequently, that appliance may not be able to establish a draft. It then begins spilling combustion pollutants from its stack into interior spaces.

The solution to this problem is simple. Install high efficiency, sealed combustion appliances in your home. Sealed combustion

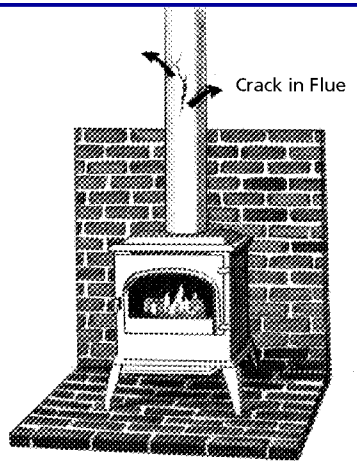
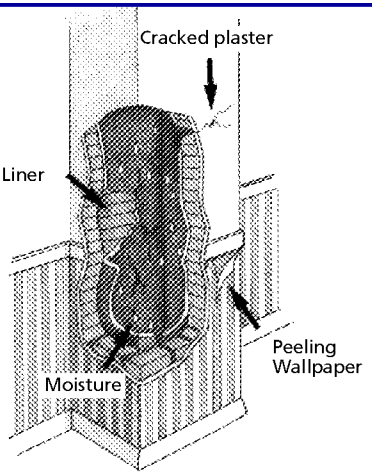


Fig. 4

CO can seep into rooms if a chimney or flue is damaged.

Fig. 5

Indications of flue or chimney interior damage.



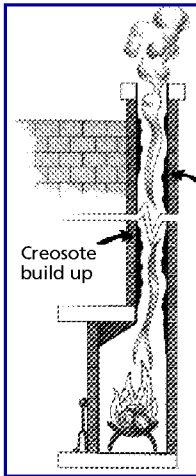


Fig. 6

Typical conditions and locations for creosote accumulation.

appliances won't backdraft because they supply their own air for combustion. They then exhaust combustion by-products outdoors, keeping interior air pressure relatively balanced. Power vented appliances have built-in safety mechanisms. These devices allow them to operate only when they are successfully venting combustion gases.

If you're concerned about negative air pressure, but don't want to invest in new appliances, call a mechanical engineer to survey your situation. Don't attempt to fix the problem yourself. Opening windows or sealing leaks in the lower level to offset depressurization could increase backdrafting problems. Also, keep in mind that the installation of large exhaust fans or whole house fans can easily depressurize a home. The result could be more unwanted spillage of combustion pollutants.

LOWERING POLLUTANT LEVELS

To reduce exposure to combustion pollutants:

- Never use a range, oven, or dryer to heat your home. Misusing gas appliances in this way, produces fatal amounts of carbon monoxide and high levels of nitrogen dioxide.
- Install and use exhaust fans over gas cooking stoves and ranges. Use a stove hood with a fan vented to the outdoors to reduce exposure to pollutants during cooking. The fan must be sized for the stove or it may exhaust too much air and decrease indoor air pressure.
- Keep gas burners properly adjusted. Improper adjustment, often indicated by a persistent yellow-tipped flame, can increase pollutant emissions. Ask your gas company to adjust the burner so that the flame tip is blue.
- Keep wood stove emissions to a minimum. Choose a properly-sized stove that is certified as meeting EPA emission standards. Make certain that doors in old woodstoves are tight-fitting. Use aged or cured (dried) wood only, and follow the manufacturer's directions for starting, stoking, and putting out the fire in woodstoves. Never burn pressure-treated wood.
- Open the stove's damper when adding wood. This allows more air into the stove. More air helps the wood burn properly and prevents pollutants from being drawn back into the house. Visible smoke or a constant smokey odor inside the home when using a wood-burning stove means the stove is not working properly. Soot on furniture in the rooms where you are using the stove is another indication of an improperly functioning stove.
- Never ignore a safety device when it shuts off an appliance. Something is wrong with the appliance. Read your appliance instructions to find out what to do, or have a professional inspection.
- Read and follow the instructions for all appliances to understand how they work. Keep the owner's manual in a convenient place to refer to when needed. Read and follow the warning labels.
- Don't idle a car inside an attached garage.
- Never use a charcoal grill indoors.
- Never ignore the smell of fuel. This usually indicates that the appliance isn't operating properly or is leaking fuel. Leaking fuel won't always be detectable by smell. If you suspect a fuel leak have it fixed as soon as possible. In most cases you should shut off the appliance, extinguish any other flames or pilot lights and shut off other appliances in the area. Open windows and doors, call for help, and leave the area.

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

Combustion Appliance Inspection and Maintenance Schedules

Appliance	Inspection Frequency	Maintenance Frequency
Gas Hot Air Heating System	Examine air filters monthly. Examine flues for rust and soot yearly.	Clean & change as needed. Qualified person check & clean chimney; clean combustion chamber; adjust burners; check heat exchanger and appliance operation. All yearly at start of heating season.
Gas/Oil Water/Steam Heating Systems & Water Heaters	Examine flues for rust and soot yearly.	Qualified person check & clean chimney; clean combustion chamber; adjust burners; check appliance operation. All yearly at start of heating season.
Kerosene Space Heaters	Check daily that mantle is properly seated when in use.	Check and replace wick yearly at start of heating season. Clean combustion chamber yearly at start of heating season.
Wood/ Coal Stoves	Yearly, check flues for rust and soot.	Qualified person check & clean chimney; clean seams & gaskets; check appliance operation. All yearly at start of heating season.

Note: Service and maintenance requiring special knowledge and equipment should be done by a professional.