

Reducing Toxic Combustion By-products

Fact Sheet



In a time of drastic change it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists. – Eric Hoffer



Building Biology Institute
The science of healthy buildings

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Gas, oil, coal, wood, and other fuels burned indoors consume valuable indoor oxygen, unless air for combustion is supplied from the outdoors. In tight, energy efficient buildings, these fumes can often lead to serious health consequences. Indoor combustion occurs in fireplaces, woodstoves, gas-fired appliances (such as ranges, clothes dryers, and water heaters), furnaces, gas- and kerosene-fired space heaters, and oil and kerosene lamps. The potentially harmful emissions include: nitrogen dioxide, nitrous oxide, sulfur oxides, hydrogen cyanide, carbon monoxide, carbon dioxide, formaldehyde, particulate matter, and hydrocarbons from natural gas fumes such as butane, propane, pentane, methyl pentane, benzene, and xylene. The indoor levels of these pollutants are determined by the amount of fuel burned and the rate of exchange with outdoor air.

Some of the possible sources of combustion by-product gases include: gas stoves, improperly vented hot water heaters, and furnaces. Hazardous fumes can leak at the pipe joints and remain undetected, especially if they occur under flooring. In addition, each pilot light adds fumes, and the burning process itself releases fumes into the air. Exposure to gas fumes primarily impacts the cardiovascular and nervous systems, but exposure can also affect any organ of the body. Some of the early symptoms from exposure to gas fumes include: depression, fatigue, irritability, and inability to concentrate.

Carbon monoxide is commonly produced during incomplete combustion, particularly from gas-fueled appliances. Carbon monoxide quickly diffuses throughout the entire building (home, school, office, etc.). Chronic exposure can result in multiple chemical sensitivities, because carbon monoxide has the ability to interfere with the detoxification pathways in the liver, allowing the accumulation of toxic substances. Other effects of chronic carbon monoxide exposure include heart arrhythmia, decreased cognitive abilities, confusion, and fatigue.

Carbon dioxide is produced from burning natural gas. Elevated levels result in decreased mental acuity, loss of vigor, and fatigue. Nitrogen oxides are also released from gas appliances. A major source of contamination is the gas stove, particularly older models with pilot lights. These gases are known to impact the nervous and reproductive systems.

Coal, gas, and wood-burning fireplaces that are not equipped with sealed doors emit particulate matter as well as toxic fumes. They also consume indoor oxygen, unless fresh outdoor air is supplied to them. Particles not expelled by blowing or sneezing can find their way into the lungs, where they can remain for years.

It is important to mention that when an automobile is parked, or operated in an attached garage, gas, oil, and other volatile organic compounds diffuse into the structure and will affect the air quality in the home. Garages must therefore be properly isolated from the main structure.

Well-ventilated and well-sealed sources of combustion can be operated with very little degradation of indoor air. However, even sources of minimum exposure must often be removed from the homes of chemically sensitive patients to restore their health.