

**Breathing The Products Of Combustion
In The Sanctuary Of Our Homes:**

**by Bruce Davis
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What is it?

Do we want to do it?

How does it occur?

How often does it happen?

Who is willing to put forth the initial and sustaining investments to bring these issues to center stage and withstand the resulting assaults?

We breathe easily at home. It's a relatively safe place to be. Right? Not necessarily. In our homes we can be breathing deadly poisons, and the worst of it is, these are poisons we manufacture ourselves by improperly using furnaces, water heaters and other household combustion appliances. How does this happen?

A house is an interactive system of interrelated components—the building shell, the building materials, all the mechanical equipment within the house, and the occupants. These interactions take place within the constantly changing environment, from season to season and from day to day.

Building materials and building designs have changed and are changing dramatically, creating new problems of interaction. New kinds of equipment are being put into houses, again changing the mix. People expect to be ever more comfortable in their homes. This places increasing demands for performance of their homes' mechanical systems. All these ingredients can render a potentially dangerous stew.

All the parts of the house should be designed to be put together and work as one integrated system, as in an automobile, for example. But houses are an assemblage of parts (often very good parts) put together in a *non*-integrated pile. Although there are good building codes and many excellent practitioners in the shelter industry, there is not currently any widespread tradition for performance testing of the interactive finished product we call our homes. Who is thinking of the big picture? Hardly anybody. So we mix old behaviors and equipment with current houses and add new-fangled things in odd blends in our new houses as we build our problem subdivisions of the future. This course of action is impelled by economic interests, consumer demands, manufacturing practice, history and the future but no one is watching to be sure that our homes—our sanctuaries—are being checked against a rational set of performance standards.

And the result can be that our homes are not the safest places to breathe easily. We can be relaxing at home, breathing in the products of combustion, thinking we are safe when in reality we are not.

Do we want to do it?

If the answer is, “yes,” or, “it doesn’t matter,” or, “we don’t care,” then the story ends abruptly. However, if the answer is “no, we should not breathe the products of combustion,” then the trail leads on and there are several opportunities before us. My answer is the latter. At least one state has formally addressed the issue, and in the past I have noticed references to others that are considering the problem. The California Air Resources Board, whose answer agrees with mine, published a booklet in May, 1994, called *Supplement to Indoor Air Quality Guideline No. 2, Combustion Pollutants in Your Home*. If the byproducts of combustion are entering the home, people can be breathing nitrogen dioxide, small inhalable particles, and polycyclic aromatic hydrocarbons. If the combustion is incomplete, which happens often, they would be breathing carbon monoxide. Often it is at sickening but sublethal, debilitating doses. Generally the lethal dose gets all the attention in the media. Another byproduct is large amounts of moisture. The moisture by itself and especially in conjunction with nitrogen dioxide provides an environment that enhances a explosion of mold spore growth. All of these impact our respiratory health. No, we do not want to breathe the byproducts of combustion.

How does it occur?

Sometimes the byproducts of combustion are dumped directly into our homes in various ways that could be controlled but are not. The solution should be simple — stop doing it. However, it is not that simple. People don’t stop for many reasons, some cultural and others economic. Many poor families heat with unvented equipment that merely dumps all the combustion byproducts into the home along with the heat. Some families believe that they are paying too much to heat their homes so they install unvented units as supplemental heat. They get all the heat — as well as all the poisons. Others use the units to supplement a malfunctioning system. A recent hot sales item is “ventless” gas logs, catering to the romantic notions people have about fire and fireplaces. Many up-scale and moderate new and existing homes have these logs dumping all the byproducts of combustion into the home. A final source is that favorite, the gas range, with its cooktop and especially its oven. Who would have thought that the Thanksgiving turkey can deliver excessive pollution along with dinner? Ranges do not vent to the outside. Even in homes with range hood fans, the byproducts are not adequately captured or the fan is not even used because it makes too much noise or is stopped up.

Another way combustion byproducts get into our homes is related to the family of mechanical fans used in our houses. Collectively, these systems can cause large enough magnitude of negative pressures to interfere with the proper operation of even *properly* installed vented combustion equipment, typically water heaters, boilers and furnaces. Simple acts such as closing an interior door or installing a powered attic ventilator on the roof, or turning on some combination of exhaust fans and the dryer can produce (and has produced) catastrophic results. The results range from irritation to illness to death or fire. Pressure-induced problems

are often elusive because out of three or four combinations of interactive pressures, maybe only one is lethal. These lethal interactions will increase as we continue to build houses containing increased numbers of mechanical fans and equipment, with more designs and more powerful equipment available. The danger increases when we continue to install the types of combustion appliances that can allow the byproducts of combustion to spill or backdraft into our homes.

How often does it occur?

It happens much more often than most people believe. Just about every time I test a house with any type of combustion equipment, I identify and measure a combustion problem that is traceable to interactive pressures caused by the operation of some combination of mechanical equipment. Other times the problem is the use of unvented equipment. It is Advanced Energy's policy that the equipment dumping the pollution into the home must be removed prior to our performing repairs. With customer education comes empowerment. The informed customer will generally choose to have the equipment removed.

We in the shelter industry have often stated that the problem is a national one. Wherever we are providing training across this nation, we measure combustion problems. Previously we have not had recording equipment in place to capture incidences. Now with the widening use of carbon monoxide detectors, we are starting to see those incidences. Many people have been surprised, though most diagnosticians were not, to learn that in some studies a noticeable percentage of alarms have been for CO-emitting gas ovens. Additionally, we also know that auto exhaust from attached garages and building air intakes located next to loading docks in commercial structures are sources for carbon monoxide in buildings.

Whether the pollution arrives directly or indirectly by interactive pressures, the unhealthy result is still the same—people breathing the byproducts of combustion. Although this is needless in a properly tuned home, it is, unfortunately, happening in houses all over America. Acknowledgment, education, training and performance testing are our paths to a healthier indoor environment.

Who is willing to put forth the initial and sustaining investments to bring these issues to center stage and withstand the resulting assaults?

That is a momentous question. I wish we had an answer.