Carbon Monoxide, Kitchen Ventilation, and Heating Systems¹

By Joe Laquatra

In the last issue of this newsletter, I discussed some findings from our Healthy Living and Learning Environments research project, which is examining indoor air quality issues. One of these issues is carbon monoxide (CO). Following testing protocols of the U.S. Environmental Protection Agency, CO levels were measured in the central living areas of houses in our sample; within five feet of central heating systems; and in oven vents at oven start-up and when oven temperatures reached 350°F. Maximum exposure levels for CO (levels which should not be exceeded) are 9 parts per million (ppm) in a central living area, 9 ppm at the central heating system, 100 ppm at oven start-up, and 25 ppm at oven temperature. We observed levels as high at 14 ppm in the central living area, 14 ppm at the central heating system, 1,544 ppm at oven start-up, and 213 ppm at oven temperature.

When we analyzed the data, we observed a significant and negative correlation between carbon monoxide levels and income (r = -.402; p = .01), indicating that lower income households in our sample were more likely than higher income households to be exposed to unsafe levels of CO. Issues related to kitchen exhaust fans were also examined. Twenty-six percent of the homes had no exhaust fan or operable window in the kitchen. Four percent had fans that did not work. Thirty percent had re-circulating fans. This represents 60 percent of the sample without operating, ducted fans in kitchens. The significant relationship between income and CO is likely due to this lack of operating exhaust fans, with lower income households more likely to be in that category. Lower income households are also more likely to have older cooking and heating appliances that are defective or have not been maintained.

In our outreach efforts to teach moisture control strategies in homes, we have stressed the importance of ducted exhaust fans over kitchen ranges, so that moisture produced during cooking will not contribute to high indoor relative humidity levels. In addition to pointing out the importance of combustion appliance inspection and maintenance, our observations from this study indicate that ducted fans are also necessary to remove dangerous levels of CO.

Previous studies have reported that exposure to carbon monoxide is common in homes and other built environments where older heating systems are improperly maintained, or where unvented combustion-type space heaters are used. When a person breathes air that is contaminated with CO, this pollutant displaces oxygen in the bloodstream, and in sufficient amounts causes blurred vision, nausea, vomiting, headaches, disorientation, loss of muscle control, unconsciousness, and death.

To some extent, everyone is exposed to CO. It is a product of combustion that is present in fumes from automobiles, lawn mowers, and other gasoline-powered machines. In fact, CO is formed when any carbon-based fuel is burned, including natural gas, propane, fuel oil, gasoline, kerosene, coal, and wood. Even though principles for preventing CO exposure are simple, between 500 and 1,000 Americans die in their homes each year from accidental exposure.

Prevention measures against CO build-up in a home include regular inspections of all combustion equipment. For furnaces, boilers, and water heaters, annual servicing includes inspecting heat exchangers, vents, motors, belts, safety turnoff switches, and chimneys. Adequate combustion air is necessary for all burners. Special provisions for this may be necessary if a furnace or boiler is

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surrounded by an enclosure. Gas burners should operate with blue flames; if they’re orange, professional adjustment is recommended.

In addition to chimney or direct venting of furnaces, boilers, water heaters, and clothes dryers, ventilation is another critical part of preventing CO build-up in a house from combustion-based appliances. Ventilation strategies include opening windows to remove polluted air and supply fresh air; using exhaust fans that are ducted to the outdoors; or using other types of mechanical ventilation systems that work by supplying fresh air and removing polluted air. This last type refers to a strategy that is important in airtight homes. Without some type of air supply system, mechanical ventilation can depressurize a house and cause pollution problems that include chimney backdrafting and soil gas entry.

Even if an exhaust fan is installed over a kitchen range, it does little good if it isn’t used. A study of residential ventilation by the New York State Energy Research and Development Authority (1998) reported that in a survey of 141 people, 67 percent indicated they had kitchen exhaust fans. Sixty-nine percent reported that they sometimes used them; and only 14 percent reported that they always used them. Not surprisingly, the reason people most often give for not using kitchen exhaust fans is noise. While this is an issue with low quality range hoods, it is not necessarily the case with equipment of higher quality.

When selecting a kitchen exhaust fan, choose one that has been rated by the Home Ventilating Institute (HVI). Choose a blower fan over an impeller fan. A blower fan (often called a squirrel cage) is a rotating wheel that looks like a hamster wheel. Blower fans move air more efficiently than impeller fans, which have blades that resemble propellers. Check the noise level which is rated in sones. A sone is a unit of loudness; one sone is the sound of a quiet refrigerator in a quiet kitchen. A low rating for a kitchen exhaust fan is about 4.5 sones.

In addition to the fan itself, a range hood should be designed to effectively capture moisture and combustion pollutants. It should overlap the range on all sides and be placed within 30 – 36 inches of the range surface. In new homes that are airtight, the provision of make-up air should be considered, and the fan air removal rate should be no greater than 600 cubic feet per minute (CFM). Generally, a kitchen exhaust fan is sized at between 100 and 400 CFM; and if no make-up air system is provided, opening a kitchen window a bit will prevent depressurization of the house. Ducting should be insulated and sized correctly for the fan; and all duct joints should be sealed.

Exposure to CO can be minimized in a home, and effective kitchen ventilation should be considered a part of this effort.

References:


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