Information Transfer

Interviews with homeowners revealed that they did not have a clear understanding of the function of ventilation systems, nor how to clean filters, use speed controls, or set dehumidistats. This lack of knowledge offsets the performance of the Ventilators and their useful service. Better transfer of information from the builder to the homeowner is essential if the homeowner is to understand how to operate and maintain the heating and ventilation systems in their houses.

Energy Performance of Three Airtight Drywall Approach Houses

Howell Mayhew Engineering Inc. For: Alberta Municipal Affairs Innovative Housing Grants Program. 9925-107 Street Edmonton ALTA T5K-2H9

FORMALDEHYDE & INDOOR AIR QUALITY

When indoor air quality is discussed, formaldehyde is the key pollutant that is usually considered.

Formaldehyde is a potent eye, upper respiratory tract and skin irritant. Some studies also indicate that it is a central nervous system depressant. It can cause asthma and induce asthmatic attacks.

Low-level formaldehyde exposures commonly found in homes are enough to worsen a variety of existing symptoms or cause them directly. In homes where formaldehyde contamination is noted, it appears to be associated with low-level sources such as furniture and paneling. Measured formaldehyde levels are in the range of 0.02 to 0.07 ppm with peak levels typically 0.05 to 0.06 ppm.

Studies at Ball State University in Indiana have established the following relationships between symptoms and formaldehyde concentrations: at an average level of 0.11 ppm: runny nose, sore throat, sleep difficulty, headache, fatigue, difficult breathing, sinus irritation, eye irritation, chest pain and menstrual problems set in. The threshold level where reactions appear is about 0.05-0.06 ppm.

One of the most notable symptoms associated with residential formaldehyde exposures is menstrual irregularities or disorders. Such irregularities have been reported in 3 different studies in 3 different countries. The relationship between menstrual irregularities and formaldehyde exposure, particularly in the residential environment, has received little attention by health practitioners.

Absence from a higher formaldehyde level environment for a month or more should provide an indication whether the menstrual disorder is associated with formaldehyde exposure.

Although formaldehyde is used in a large variety of consumer products, some release quantities of free formaldehyde in enough quantity to significantly contaminate indoor air. Problem products use urea-formaldehyde resins in their manufacture. These include particleboard subflooring, paneling, cabinetry, furniture, and hardwood plywood paneling. For wood products these resins are used interior-grade adhesives.

Formaldehyde and Ventilation

A National Research Council of Canada study measured indoor formaldehyde levels and ventilation rates for sixteen similar houses and used a simple model to relate these two items. The houses were one to two years old wood frame bungalows with full depth cast in place concrete basements.

The net source strengths calculated suggested that in these houses the major interior source of formaldehyde were the building components themselves.

Conventional homes with particleboard subflooring (2-5 years after installation) have measured levels of formaldehyde in the range of 0.06 to 0.30 ppm with peak levels in the range of 0.20 to 0.30 ppm. With low emission particleboard materials which are becoming available in the USA, peak formaldehyde levels associated with a newly applied subfloor can be expected in the range of 0.10 to 0.15ppm. Kitchen and bathroom cabinets alone have the potential for causing residential formaldehyde to rise to levels of 0.10ppm or higher, specially when they are new.

The mobile home, however, exposes its residents to the highest formaldehyde levels. Formaldehyde levels in mobile homes have been measured in the range of 0.20 - 0.50 ppm with values as high as 1-2 ppm reported for mobile homes manufactured before 1980.

The indoor relative humidity was not well related to the ventilation rate. Thus the study questions the effectiveness of controlling ventilation by an indoor dehumidistat.

Bedroom formaldehyde levels were significantly higher than the living room levels, suggesting that design of the air distribution system must be given careful consideration.

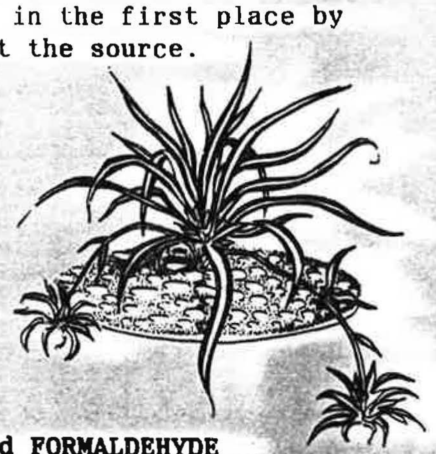
The relationship between temperature, humidity and the formaldehyde release rate from building materials is complex and not well understood at the present time. However, increasing the temperature or relative humidity will increase the steady-state formaldehyde concentration for a given air flow. Results show that increasing the indoor air temperature from 20°C to 23°C will increase the formaldehyde concentration by about 15%. Increasing the indoor relative humidity from 40% to 50% causes an increase in formaldehyde concentration of about 35%.

The National Research Council Study suggested that in general, humidity does not appear to be a good indicator or basis for control of indoor air quality control. It also found that the natural ventilation rate was inadequate for indoor air quality control. A minimum air change rate of approximately 0.3 ach would be required to maintain acceptable levels of indoor formaldehyde.

In houses without forced air heating systems, the air exchange system must circulate air through the entire house to prevent localized areas from having low ventilation and high pollutant concentrations.

The choice of building components that do not emit formaldehyde (reducing the source strength) can reduce the amount of ventilation required to control this pollutant. Since other indoor air pollutants may also be present, reduction of formaldehyde sources is not, by itself, a justification for reducing supply air quantities.

As becomes evident, selection of appropriate building materials is by far the better way to achieve good quality indoor air quality. Ventilation systems should not be relied upon to remove contaminants that could be avoided in the first place by proper control at the source.



SPIDER PLANTS and FORMALDEHYDE

A form of air purification which has received much attention is the use of house plants, especially spider plants (SOLPLAN REVIEW NO.3). The idea of botanical air purification is based on the research of B.C. Wolverton, a NASA scientist. His work demonstrated that spider plants can remove a considerable amount of formaldehyde from a onetime infusion of formaldehyde into a spider plant-occupied test chamber.

As a result of the publicity, many homeowners have employed spider plants to "purify" the air of their homes.

Despite the glamour of this technique, it is in fact not effective in reducing formaldehyde in an environment where it is continuously produced. In Wolverton's experiments formaldehyde was not continuously produced as is the case of residential environments where urea-formaldehyde resins are the dominant source.

In experiments at Ball State University spider plants consumed formaldehyde, but it was quickly replaced by the formaldehyde sources present in the test chamber itself. The small amount of formaldehyde control (up to 20%) that spider plants could achieve were offset by the increased emissions of formaldehyde caused by the increase in relative humidity associated by the presence of the plants themselves. The reason for this is that the off-gassing of formaldehyde goes on until it reaches an equilibrium balance that depends on moisture conditions and temperatures in the space.

The Ball State University researchers thus concluded that Spider plants are not effective in controlling formaldehyde in residential environments.