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105 MEDIA

Building Materials Can Be a Major Source of Indoor Air Pollution

Indoor air quality can be improved by controlling the sources of VOC emissions.

BY BRUCE MITCHELL

Asthma is an increasingly common respiratory condition that affects up to 30 percent of children and 10 percent of adults in the developed world.[1] Exposure to certain chemicals, such as formaldehyde and phthalates, has been associated with increased risk of asthma, allergies and pulmonary infections.[2,3] Asthma sufferers are more susceptible to inhaled irritants, which means they can experience an adverse response to a lower concentration of a hazardous chemical air pollutant than a non-asthmatic person would.[2] Therefore, the quality of indoor air is of great importance to health, especially when people today spend up to 90 percent of their time indoors. However, indoor air can contain more pollutants than the air outside.[4] For example, the concentration of phthalates can be 100 to 1,000 times higher indoors.[5]

A major class of indoor pollutants are volatile organic compounds (VOCs), chemicals such as formaldehyde that can evaporate under normal atmospheric conditions. According to a World Health Organization (WHO) classification system, VOCs are defined by a boiling point range with a lower limit between 50-100°C and an upper limit between 240-260°C.[6] Less volatile chemicals are classified as semi volatile organic compounds (SVOCs) and defined by a boiling point range of 240-260°C to 380-400°C.[6]

VOCs can be emitted into indoor air from a variety of sources, such as building materials, flooring, composite wood products, and adhesives. Adhesives used during flooring installation, for example, can represent a significant source of VOC emissions into the air.[7] Despite their lower volatility (due to their higher boiling points), SVOCs such as phthalates also can be emitted from a variety of sources in the home. Over a prolonged time period, the emission of SVOCs from flooring adhesives can even exceed that of VOCs.[7] In the indoor environment, SVOCs can be present in the gas-phase, airborne particles and house dust, and therefore home occupants can be exposed to these compounds by both the inhalation of air and house dust.[8]

Adhesive formulations contain numerous chemical components, both volatile and non-volatile. They are generally made up of binders (1. high molecular weight polymers or 2. reactive compounds that will form polymers during the binding process) combined with other constituents, such as plasticizers, fillers, thickeners, solvents, stabilizers, preservatives, etc.[9] For flooring adhesives, the emission of compounds is not limited to the period during and immediately after adhesive application.

In addition to such primary emissions, secondary emissions may occur as a consequence of chemical or microbiological reactions in the adhesive or environment. For example, the decomposition of flooring adhesives due to the presence of a moist, alkaline environment has been found to be an important source of secondary emissions of VOCs.[10]

Using low-VOC-emitting products and materials during renovations can contribute to the goal of achieving a total VOC range closer to that of older buildings, thus avoiding discomfort or more serious complaints for the occupants.

In response to the health concerns related to the release of chemicals from flooring adhesives, many manufacturers have turned their attention to the development of low-solvent, low-VOC-emitting alternatives. This advance is to be welcomed because indoor air quality can be improved by controlling the sources of VOC emissions. To help contractors make informed decisions about which materials to choose, there are flooring materials available that have been CERTIFIED asthma & allergy friendly™ by the Asthma and Allergy Foundation of America (*www.aafa.org*) for both loose-lay (no glue) and adhered (glue-down) applications. We are deeply involved in conducting real-time biomedical studies and aerobiological research needed for a wide range of materials to achieve this certification, which centers around allergen removal validation studies in indoor, climate-controlled environmental test chambers.

The concentration of total VOCs in new or newly renovated buildings ranges from 0.5-19 mg/m^3, likely related to the amount of newly installed construction materials and contents. By contrast, total VOC concentrations in older or established buildings range from 0.2-1.7 mg/m^3.[2,11] It has been suggested that discomfort due to odor, headache, or eye/nose/throat irritation is unlikely at total VOC levels under 0.2 mg/m^3. Complaints occur in most buildings at total VOC

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levels over 3 mg/m^3, while at more than 5 mg total VOCs/m^3, measures of respiratory tract irritation rise significantly.[12,13]

The use of low-VOC-emitting products and materials during renovations can contribute to the goal of achieving a total VOC range closer to that of older buildings, and thus avoiding discomfort or more serious complaints for the occupants. **OHS**

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