



Flooring and Indoor Air Quality (IAQ) - A Challenge to Common Misperceptions

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Indoor air quality (IAQ) has impacted the built environment since the days of dirt floors and mud huts. But IAQ is not just a millennia's old issue. Modern research indicates that IAQ can impact academic performance in schools,¹ productivity in office environments² and health outcomes among patients and staff in hospitals.³

While controlling pollutants from raw materials and manufacturing processes is key to healthy indoor air, flooring – one of the most abundant finishes in the built environment – offers an important opportunity to positively impact IAQ.

A key factor to consider when specifying floor coverings is how different flooring systems might trigger asthmatic and allergic reactions in building occupants or cause the development of asthma symptoms in people who are sensitive to such impacts. Another key consideration is the concentration of volatile organic compounds (VOCs) found in different flooring and flooring-related products which can be emitted as gasses.

Asthma and Allergens

Asthma is a chronic lung disease that can be life threatening. According to the Centers for Disease Control and Prevention (CDC), an estimated one in 12 people have asthma, and the numbers are rising every year.⁴

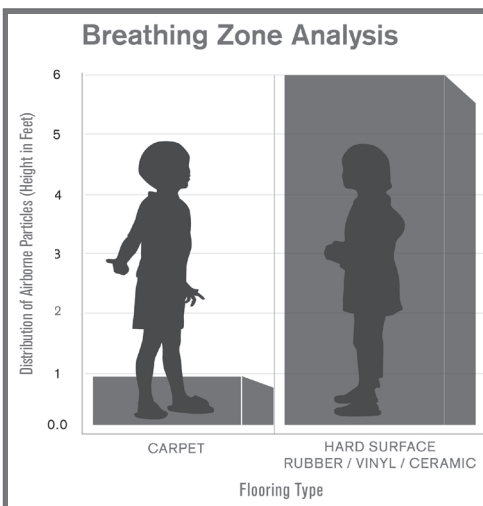
One in six asthma cases is caused or worsened by occupational exposures.⁵ Asthma is also one of the most common chronic disorders in childhood, currently affecting an estimated 7.1 million children under 18 years of age and a main reason that students miss school due to illness.⁶

Asthma cost the U.S. approximately \$56 billion in medical costs, lost work and school days, and early deaths in 2007.⁷ Each year, asthma accounts for more than 8 million doctor visits and 479,000 hospitalizations.⁸ Adults are nearly seven times more likely than children to die due to asthma. The asthma mortality rate is highest for people 65 or older.⁹

Triggers for asthma attacks and allergies

In a closed, unoccupied space, respirable particulates such as pollen, mold spores, dust mite feces and animal danders that can trigger asthma attacks and allergies tend to accumulate on the floor. When a person enters the space, body movement and footfalls can easily disturb the particulates, stirring them up and carrying them into the breathing zone which the U.S. Department of Labor defines as within a 10-inch radius of a worker's nose and mouth.¹⁰ Once particulates are airborne, their distribution becomes independent of the flooring. HVAC systems, drafts from open windows and wind currents from fans can further agitate the particulates and keep them airborne. A cloud containing particulates above the breathing zone very likely contains particulates all the way down to floor level.

It is a common misconception that carpet contributes to asthma and allergies in people. However, clinical studies dating as far back as the 1980s and into the present have demonstrated conclusively that carpet does not trigger symptoms



This published study concluded that soft surfaces such as carpet and textile composite flooring are more effective than hard surfaces at holding particulates and allergens out of the breathing zone.

Source: Luedtke A. "Floor Coverings Dust and Airborne Contaminants." International E-Journal of Flooring Sciences. August 2003.

ASTHMA AND COPD IN THE ELDERLY

Asthma is usually considered a disease of younger people, but asthma mortality is currently greatest in people over the age of 65. Asthma affects more than 10 percent of the population within this age group.²⁴ Mortality rates for these people are four times higher than those in adults ages 35-64 and 12 times higher for people ages 19 and younger.²⁵

Approximately 15.3 million adults (6.4 percent) have reported ever being diagnosed with chronic obstructive pulmonary disease (COPD), which includes bronchitis and emphysema.²⁶ Most adults with COPD are over the age of 65.²⁷

Research indicates that people spend approximately 90 percent of their time indoors where the air can be significantly more polluted than the air outdoors.²⁸ People, such as the elderly, who may spend the most time exposed to indoor air pollutants are often most vulnerable to its effects. This is particularly true of people who have respiratory or cardiovascular disease.²⁹

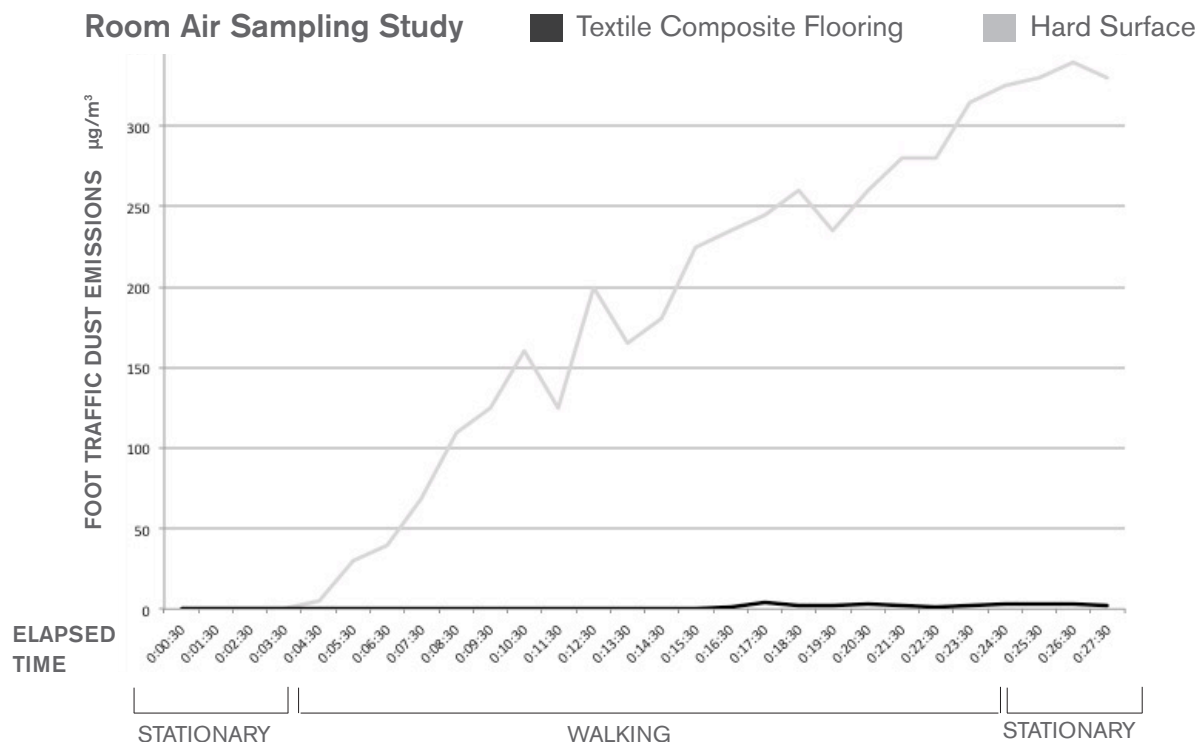
of asthma and allergy. The Carpet and Rug Institute (CRI) commissioned an independent, third-party research organization to survey scientific studies published from 1997 to 2014, and no study found carpet to be a trigger for asthma and allergies.

For example, a 2012 study by Shaughnessy and Vu found that a carpeted floor when walked on produced fewer airborne particles than a vinyl floor.¹¹ A study presented at the American College of Allergy, Asthma and Immunology annual conference in 2012 demonstrated that traditional carpet cleaning methods result in significant decreases in airborne allergens....challenging the assertion that carpet requires special cleaning methods to control particulate emissions.¹²

A room air sampling study conducted in 2013 by an independent, third-party laboratory tested foot traffic emissions on textile composite versus vinyl flooring and found that textile composite sequestered particulates, helping to keep them from rising more than about one foot above the floor. Similar results have been found in studies of foot traffic on carpet.

By contrast, the study showed that in in the same space with vinyl flooring, the particulates can rise well into the breathing zone of an adult. Once particulates are airborne, flooring is no longer a factor and suspension time depends entirely on particle size and if the air is static or in motion. Air movement keeps particles suspended for longer periods of time. Lighter particles tend to stay suspended longer, sometimes for days.

The findings of the 2013 study are consistent with results of comparable tests that have been conducted over time, ever since the first testing in Sweden in the early 1980s.¹³



IAQ AND STUDENT PERFORMANCE

Young children are particularly vulnerable to indoor air pollution. They breathe in the same concentrations of pollutants as adults but breathe in more oxygen relative to their body weight. Because children are still developing, indoor air pollutants pose a greater risk of damage to their respiratory and neurological systems.³⁰

In schools, poor IAQ can lead to increased absenteeism due to respiratory infections, allergic diseases from biological contaminants or adverse reactions to chemicals. The EPA lists microbiological pollutants and chemicals contained in cleaning products among building factors or building pollutants most commonly associated with respiratory health effects.³¹

Asthma is one of the most common chronic childhood disorders. It affects an estimated 7.1 million children under the age of 18. Asthma is the third leading cause of hospitalization among children under the age of 15 and a leading cause of school absenteeism. In 2008, it accounted for an estimated 14.4 million lost school days in children who suffered an asthma attack in 2007.³²

Research shows that children's performance declines with illnesses or absences from schools, and that student performance can be affected when teachers are absent due to illness.³³

VOC Emissions and Chemicals of Concern

VOCs are usually found in emissions from chemicals commonly used in the manufacture and maintenance of building materials, interior furnishings and cleaning supplies. They are found in drywall, paint, furniture, floor coverings, office supplies, electronic equipment and many other products. Practically every natural and man-made material emits VOCs of some type.

Short-term exposure to high levels of VOCs have been associated with eye and respiratory tract irritation, headaches, dizziness, visual disorders and impaired memory. Long-term exposure to high levels of some VOCs have been linked to cancer.¹⁴ Chemical contaminants from indoor sources combined with inadequate ventilation may contribute to sick building syndrome or building-related illness.¹⁵

With flooring, VOCs may be emitted during installation, maintenance and post-installation of both soft-surface and hard-surface flooring, though in different amounts. Emissions come from the flooring products, the adhesives used to install them and the chemicals used for their maintenance.

The U.S. Environmental Protection Agency's (EPA) list of "chemicals of concern" includes substances that are potentially hazardous to human health or the environment.¹⁶ With flooring, some of these chemicals of concern and other chemicals containing VOCs may off-gas during product installation, post-installation and possibly during demolition of existing flooring products during renovation.

Polishes, waxes and strippers that are commonly used in the maintenance of vinyl flooring and other hard surface floor coverings vary greatly in their formulations and can potentially be high emitters of VOCs. For example, a traditional finish-stripper has a VOC level greater than 10 percent, and commonly between 15 and 30 percent.¹⁷ Recognizing that VOC emissions are a major contributor to ground-level ozone which is a public health concern, the EPA and nearly 20 states to date have enacted regulations limiting VOC emissions from various sources, including floor polishes, waxes and strippers. Currently, some regulations are in effect whereas others will become effective in 2016 and beyond.¹⁸

By contrast, soft-surface flooring products such as carpet and textile composites can be cleaned with detergent and water which emit little to no VOCs. Those detergents that have been found to be most effective for cleaning carpet and have received the CRI's "Seal of Approval" are listed on CRI's website in the "Certified Cleaning Solutions" section.¹⁹

Additionally, the carpet industry is partnering with nationally recognized green certifiers such as the EPA's Design for the Environment program to certify that Seal of Approval cleaning products do not damage the environment. To become a Seal of Approval green product, the manufacturer must provide CRI with documentation from one of the green partner organizations proving that its product meets the certifier's environmental requirements.

COMMON MISPERCEPTIONS ABOUT FLOORING AND IAQ

1. Contrary to popular belief...carpet is not a source of IAQ problems.³⁴
2. There is no known link between carpet and asthma or allergies.³⁵
3. Carpet sequesters allergens, keeping them from becoming airborne and rising into the breathing zone.³⁶
4. Carpet is not a major emitter of VOCs.³⁷
5. The chemicals in carpet pose no health risks of public concern.³⁸
6. Formaldehyde is not used to manufacture carpet.³⁹
7. Carpet does not contribute to HAIs in hospitals.⁴⁰

Low-VOC certifications

To help improve indoor air quality, consider if a flooring product meets or exceeds IAQ performance standards. The most common certification labels include Green Label Plus, FloorScore® and Greenguard.

California's Department of Public Health Services Standard Practice for Specification Section 01350 is considered the world's strictest specifications for distinguishing low-emitting materials in schools, hospitals, office buildings and other commercial settings. The language contained in CA 01350 has been integrated into other specification programs such as Green Label Plus, FloorScore, GreenGuard and the U.S. Green Building Council's (USGBC) LEED program.²⁰

CRI's Green Label Plus program is a voluntary, independent testing program that identifies carpets, adhesives and cushions with very low VOC emissions. It is the carpet industry's standard for IAQ, and it requires products to at least meet California's Department of Public Health Services Standard Practice for Specification Section 01350.²¹

The FloorScore® certification program was developed by the Resilient Floor Covering Institute with SCS Global Services to identify resilient floor coverings such as vinyl, rubber, laminate and hardwood as well as flooring adhesives that meet the program's strict IAQ requirements.²²

UL Environment's Greenguard Certification Program provides third-party assurance that products designed for use in indoor spaces meet strict chemical emissions limits.²³ The program's primary test method for flooring products is the "Standard Method for Measuring and Evaluating Chemical Emissions from Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers." Chemical emissions are measured during product testing to simulate actual use.

Most flooring and adhesive manufacturers pursue both Green Label Plus and FloorScore certifications for their products.

Emissions testing under LEED v4

The USGBC's LEED Version 4 (v4) is expected to bring changes to the program's requirements for using carpet in new construction. For example, whereas LEED 2009 (aka LEED v3) required, in part, that all interior carpet, carpet cushion and carpet adhesives meet testing and product requirements of the Green Label Plus program and all interior hard surface flooring meet requirements of the FloorScore standard – both of which measured total amounts of VOCs – LEED v4 requires greater transparency about which VOCs are found in these products.

The USGBC's LEED Version 4 (v4) will bring changes to the program's requirements for using carpet in new construction. For example, whereas LEED 2009 (aka LEED v3) required, in part, that all interior carpet, carpet cushion and carpet adhesives meet testing and product requirements of the Green Label Plus (GLP) program and all interior hard surface flooring meet

requirements of the FloorScore standard – both of which measured

Conclusion

Indoor air quality is an important health consideration when specifying flooring for the built environment. The impact of IAQ on worker productivity in office buildings, student performance in schools, and health outcomes of patients and staff in hospitals has been well documented.

The two most important IAQ factors to consider when specifying flooring are the product's VOC emissions and its ability to sequester airborne particulates. Products that meet rigorous IAQ standards for low VOC emissions may be identified by third-party certification labels such as Green Label Plus, FloorScore and Greenguard. Low emitting flooring products can assist projects that are pursuing LEED v4 certification to achieve their commissioning testing protocols.

Independent laboratory tests show that, unlike hard surface flooring, carpet and textile composite floor coverings are effective in keeping respirable particulates out of the breathing zone, contributing to healthier IAQ.

Notes

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