IMPROVING INDOOR AIR QUALITY IN THE BUILT ENVIRONMENT

Improving Indoor Air Quality in the Built Environment

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Improving Indoor Air Quality in the Built Environment



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Learning Objectives

At the end of this course, you will be able to:

- **1.** Understand how IAQ is measured and the impact it has on occupants
- **2.** List contributing factors to poor IAQ both during construction and after occupancy
- **3.** Discuss how improving IAQ requires a specific strategy that includes material and product selection
- 4. Explain the importance of selecting flooring materials and systems that promote improved IAQ



UNDERSTANDING INDOOR AIR QUALITY (IAQ)

Indoor Air Quality (IAQ)

- > Awareness has grown regarding the impact of poor IAQ
 - Top 5 most urgent environmental risk to public health*
- > Health issues associated with poor IAQ include headaches, fatigue and respiratory problems
- > Long term health damage from poor IAQ is becoming more common



- > According to the CDC Americans spend 90% of their time indoors^{*}
- > Indoor air quality can be up to 10 times worse than outside air quality
- > More than 20 million Americans have asthma, compounding poor IAQ health risks



(1) *Source: CDC. Healthy Housing Reference Manual. Chapter 5: Indoor Air Pollutants and Toxic Materials.http://www.cdc.gov/nceh/publications/books/housing/cha05.html

Common Pollutant Categories

- > Biological
 - Excessive concentrations of mold, dust mites, animal dander, and pollen may result

> Chemical

• Sources of chemical pollutants (gases and vapors) include emissions from products used in the building

> Particle

• Particles are solid or liquid, non-biological, substances that are light enough to be suspended in the air such as dust.

Irritants

- > Common irritants can impact the health of everyone
- > Common irritants include chemical fumes, smoke, and VOCs
- Volatile organic compounds (VOCs) are emitted as gas from certain solids or liquids



Allergens

- > Allergens impact people that have a specific sensitivity to the material
- > Common allergens are pet dander, dust mites and mold
- > Some allergens can trigger asthma attacks



Common irritants can impact the health of:

- A. Allergy sufferers
- B. Everyone
- C. Those with asthma
- D. Irritants don't impact your health



Workers and Indoor Air Quality

- > Poor IAQ can significantly impact occupants and businesses
- > Health problems associated with poor IAQ result in lost work time, lower productivity, and other costs to employers
- > OSHA estimates poor IAQ costs \$15 billion annually to businesses



Sick Building Syndrome (SBS)

- Sick Building Syndrome (SBS) is a term used to describe buildings with persistent poor IAQ
- > No specific source is usually identified with SBS
- > When a known cause of poor IAQ is found, it can be labeled as a Building Related Illness (BRI)
- > American Legion Convention Philadelphia 1976^{*}



(1) *Source: Response to Sick Building Syndrome and Building Related Illness Incidents – February 2002 http://www.usfa.fema.gov/pdf/efop/efo33870.pdf

Contributing Factors to Poor IAQ

Avoid Toxins in the Healing Environment



Tight Buildings, Poor IAQ

- Improvements to the building envelope are designed to improve energy efficiency
- > Tighter buildings lead to less natural air flow to the outside
- > Stale or captured air can increase poor IAQ



- > New building materials can introduce VOCs into breathing space because they have less time to off-gas
- > Paint, adhesives, solvents, upholstery and furniture are common sources for VOCs
- > Common VOCs include Formaldehyde, Styrene, and flame retardants



Occupant Introduction of VOCs

- > Occupants use can increase the number of VOCs in the enclosed space
- > Regular office equipment like computers, printers and copiers can off-gas VOCs
- > Daily choices can greatly impact IAQ



Indoor Air Quality (IAQ)

- > Cleaning and maintenance can add additional irritants and toxins to the breathing space
- > Detergents, solvents, paints, lubricants and sealants are often laden with VOCs
- > What may seem clean visually can actually be very harmful to our lungs



How do "tight buildings" contribute to poor IAQ?

- A. Without proper ventilation pollutants get trapped inside the building.
- B. The manufacturing process for tight buildings leads to poor IAQ for site workers.
- C. Tight enclosed areas can be more prone to mold spores, causing poor IAQ.
- D. Windows are opened more often in tight buildings, allowing allergens into the building





IMPROVING IAQ DURING DESIGN PROCESS

- > Volatile Organic Compound VOC: reporting usually refers to emission levels of individual chemicals. VOCs are both man-made and naturally occurring.
- > Total Volatile Organic Compounds TVOC: refer to total VOC emissions measured using Toluene as the calibration measure. It is possible for a TVOC number to mask an individual VOC emission that exceeds its safe limit.

Total VOCs and IAQ

- > Total VOCs (TVOCs)
- > A more accurate way to evaluate IAQ
- Encompasses building materials, daily usage, and maintenance



Testing for TVOCs

- > Testing for TVOCs can be done with hand-held or stationary devices
- > Canisters capture whole air samples
- > Many laboratories are available to evaluate TVOC levels



Standards for VOC Testing

- > Few specific recommendations on healthy TVOC levels
- > LEED for new construction suggests maximum 500 micrograms per cubic meter
- > Evaluating individual VOCs within TVOC is critical to achieve healthy IAQ



Standards for VOC Testing

- > ASHRAE 189.1 (2009) Standard for the Design of High Performance Green Buildings Except Low-Rise Residential Buildings
- > ANSI/ASHRAE Standard 62.2-2007. Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
- > CA Department of Health Services: Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers: "CA Section 01350"



Impact of Poor IAQ

- > The potential impact of poor IAQ is extreme
- > Exceeding conventional expectations for TVOC levels is possible
- Many resources and solutions are available to the architect to improve IAQ
- > Good IAQ contributes to favorable and productive environment*



(1) *Source: OSHA Indoor Air Quality in Commercial and Institutional Buildings https://www.osha.gov/Publications/3430indoor-air-quality-sm.pdf

Minimizing Emissions

- > Choose low-emitting products at point of design
- > Flooring materials and systems as part of IAQ strategies
- Must understand all aspects of flooring systems and avoid products or processes with high VOC levels



Flooring Systems

- > Wide range of flooring options available
- Carpets, vinyl and laminate historically have higher VOC levels, but not always
- > Many adhesives and sealants can now be found with low VOCs



What is the LEED maximum threshold for TVOCs?

- A. 100 micrograms per cubic meter
- B. 500 micrograms per cubic meter
- C. 2,500 micrograms per cubic meter
- D. 10,000 micrograms per cubic meter



Flooring Adhesives

- > Almost all flooring systems require some kind of adhesive
- > There are several types of adhesives used today: water based, solvent based, urethane based, latex based and powder adhesives
- Latex and water based adhesives will typically be lower-VOC than traditional adhesive types



Flooring Materials and TVOCs

- > Flooring materials may contain urea formaldehyde, a known carcinogen
- > Avoid materials with added urea formaldehyde to improve IAQ
- > Phenol formaldehyde is a healthy alternative, but may be more expensive



Floor Maintenance

- > The right flooring system can lower TVOC levels through easy care and maintenance
- > Floors can be cleaned through simple sweeping, or water mopping
- > Dry buffing floors are a better choice



Antimicrobial and Antifungal Treatments

- > Antimicrobial and antifungal treatments are banned in Europe, but available domestically
- > Toxicity of antimicrobial chemicals have led to some popular ones being banned
- > Caution should be used before introducing more toxins into the breathing space



Polybrominated Diphenyl Ethers (PBDEs)

- > Flame-retardants became popular in the 1970s
- > PBDE was a popular choice however, it has severe negative health consequences
- > Additional chemicals in the breathing and work space should be avoided if possible



Carpeting and IAQ

- Traditional carpet can pose a significant trigger risk to allergy sufferers if not maintained properly
- > VOCs in carpet are mainly in the adhesives and padding
- If project requires carpet, it should be one that is engineered to survive frequent cleaning



What are TVOCs?

- A. Total Variable Organic Compound
- B. Total Volatile Organic Compound
- C. Total Visible Outdoor Cycle
- D. Total Veneer on Cabinets





SELECTING FLOORING THAT SUPPORTS IAQ

Asthma & Allergy Friendly[™] Certification

- > Specific certification related to indoor asthma triggers and allergens
- > Categories cover all aspects of occupant use and exposure from building materials to cleaning and maintenance



GREENGUARD® Certification

- > Certification quantifies over 360 different VOCs
- > Meets stringent CA 01350 standard
- > Includes TVOC examination and a level under 500 µg/m³



FloorScore® Certification

- > Specifically evaluates hard surface flooring
- > Meets many standards for schools, homes, and hospitals
- > Product certification requires annual audits and onsite visits
- > Meets stringent CA01350 standards



- > Voluntary testing for carpet, adhesives and cushion products
- > Created by the Carpet and Rug Institute (CRI)
- > Satisfies CA 01350 requirements and is the only ANSI-accredited green carpet program in the U.S.



Green Seal Certification

- > Life cycle-based sustainability certification
- > Prominent certification for cleaning products and building materials
- > GS-36 certifies adhesives for commercial use



- > NSF offers third party independent testing
- > ANSI creates standards based on tests and stakeholder recommendations and is open to industry scrutiny
- > NSF/ANSI standards are internationally recognized as legitimate resources or products and processes



- > NSF/ANSI 332 Sustainability Assessment Standard for Resilient Floor Covering
- > NSF/ANSI 140 Sustainability Assessment for Carpet
- > NSF/ANSI 336 Sustainability Assessment for Commercial Furnishings Fabric



Cradle to Cradle

- > Certification looks at entire life-cycle of product
- > Five categories are evaluated for overall sustainability including material health assessment
- > LEED credits available when selecting C2C products





REVIEW

Which of the following is a symptom of poor Indoor Air Quality (IAQ)?

- A. Headaches
- B. Fatigue
- C. Eye, nose and throat irritation
- D. All of the above



- > IAQ is increasingly becoming a concern
- > Allergens, irritants, and VOCs can lead to negative health consequences
- > SBS and time from work both impact productivity and the economy



- > Tighter building envelopes are trapping irritants and VOCs inside
- > VOCs and irritants are introduced into the building with construction materials and furnishings
- > Daily use, cleaning, and maintenance can continually add toxins into the breathing space



- > TVOCs are an important metric in evaluating IAQ
- > Flooring systems can offer a positive way to reduce VOCs in the occupied space
- > Planning for lower TVOCs during construction, and during occupancy is critical for the health and well being of occupants



- Many low-VOC certifications and designations are available today for flooring products
- > U.S. EPA offers resources and certifications for building materials
- NSF/ANSI Standards as well as Cradle to Cradle are helpful ways to design a healthy living and work space



