



GREENGUARD Environmental Institute is an industry-independent not for profit organization focused on helping you create healthy indoor environments.

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GREENGUARD Environmental Institute

is a USGBC Education Provider committed to enhancing the professional development of the building industry and LEED Professionals through high-quality continuing education programs.

As a USGBC Education Provider, we have agreed to abide by USGBC-established operational and educational criteria, and are subject to course reviews and audits for quality assurance.

USGBC EDUCATION PROVIDER

Course Name : **Healthy Indoor Air Quality by Design**
 Approved for **1** GBCI CE Hours for LEED Professionals.

Overview:

- What is acceptable indoor air quality and why is it important?
- How can we enhance the quality of air we breathe?
- Emissions in codes and standards
- Who to trust

What is acceptable indoor air quality?

- ASHRAE Standard 62.1-2010 states:
 - “Air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of people exposed do not express dissatisfaction”

–What’s your opinion? **Yes** **No** **Maybe**

Why is Indoor Air Quality Important?

- We spend about 90% of our time indoors
- Adults breathe 20-30K times per day
- Air pollutants are 2-5x higher inside than out
- There are thousands of chemicals and biological pollutants known today
- More are discovered as building materials evolve



What can we find in the air we breathe?

- Volatile Organic Compounds (VOCs)
- Inorganic and organic particulates, allergens
- Formaldehydes/Aldehydes
- Inorganic & combustion gases
- Mold & mildew



Building Evolution & the Impact on Indoor Air Quality



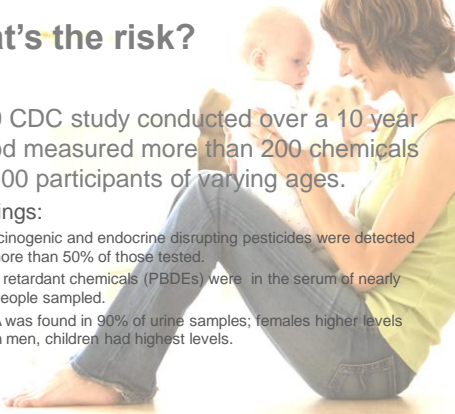
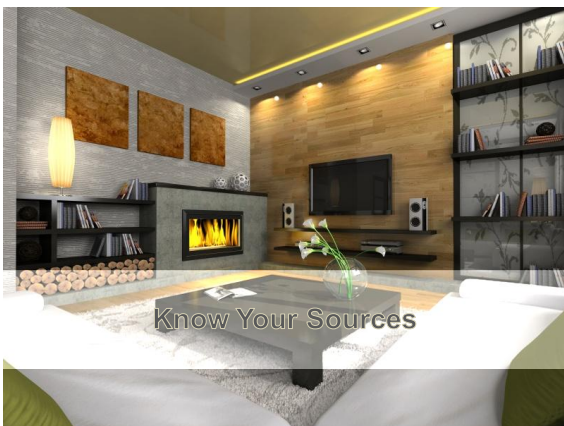
- Shift from natural to mostly synthetic materials
- Compacted work spaces
- Decreased ventilation
- Buildings don't breathe
- Designs can lack necessary contextual response

What's the risk?

- 2009 CDC study conducted over a 10 year period measured more than 200 chemicals in 2500 participants of varying ages.

Findings:

- Carcinogenic and endocrine disrupting pesticides were detected in more than 50% of those tested.
- Fire retardant chemicals (PBDEs) were in the serum of nearly all people sampled.
- BPA was found in 90% of urine samples; females higher levels than men, children had highest levels.

The Impact on Human Health



- Eye irritation
- Headache
- Upper Respiratory Irritation
- Nausea, dizziness
- Fatigue
- Sore or dry throat
- Nose bleed

Indoor Air Quality and Asthma



Indoor Air Quality and Asthma

Asthma in the U.S.

- Diagnosis in children has increased 160% in a decade

Every day in the U.S.

- 40,000 people miss work due to asthma
- 30,000 people suffer attacks
- 5,000 people visit the ER due to a severe attack

Every year 5,000 people die from this incurable disease

Research now suggests that continuous exposure to high levels of VOCs can even lead to the onset of the disease

Who's looking out for you?



- Failure of Toxic Substances Control Act (TSCA) adopted in 1976 to help EPA maintain inventory of toxic substances.
- EPA data for only 200 of these chemicals (US EPA)
- Only 5 of the 20,000 chemicals introduced since 1976 banned by EPA (source: Environment and Human Health, Inc. report, Wargo, 2010)
- FTC Green Guidelines only encourage third party certification of "green products" (US Federal Trade Commission)

Who's looking out for you?

Toxic substances are everywhere:

from metals, adhesives, plastics, solvents, flame retardants, sealants and biocides

Chemicals not addressed by rating programs for credit purposes:

- Particulates smaller than 10 micrometers
- Pesticides
- Flame retardants
- Plastics: Bisphenol-A, PVC, Phthalates



Who's looking out for you?

Only 7 out of 110 possible LEED points have the primary intent to limit hazardous chemicals within the built environment. (USGBC LEED BD+C v. 3, 2009)

90% of US chemicals are exempt from federal review under TSCA. (US EPA)

95% of the materials submitted by manufacturers are listed as "proprietary in nature" and therefore not disclosed to the public. (Enviro & Human Health Inc. report 2010)



Content v. Emissions in LEED Credits

LEED Program 2009 Version 3	BD&C	BD&C Healthcare	BD&C Schools	ID&C
Credit 4.1- Adhesives/Sealants	content	content	emissions	content
Credit 4.2- Paints Coatings	content	content (Op 2 paint)	emissions	content
		emissions (Op 2 ceiling /wallpaper)		
Credit 4.3- Flooring Systems	emissions	emissions	emissions	emissions
Credit 4.4- Composite Wood/Agri-fiber	content	content	emissions	content
Credit 4.5- Furniture/Furnishings	n/a	emissions	emissions	emissions

Content v. Emissions Case Study

Air Quality Sciences Study 2011, Comparison of VOC Content v. VOC Emissions from Paint

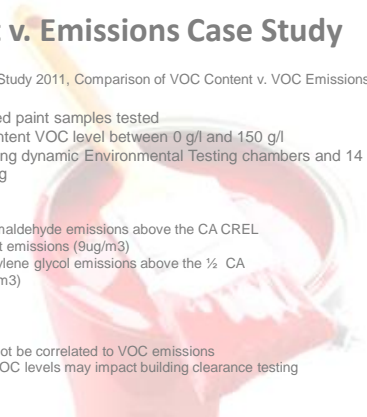
- 26 un-tinted paint samples tested
- Stated content VOC level between 0 g/l and 150 g/l
- Tested using dynamic Environmental Testing chambers and 14 day testing

Findings:

- 7 samples had formaldehyde emissions above the CA CREL limit for dry product emissions (9ug/m³)
- 2 samples had ethylene glycol emissions above the 1/2 CA CREL limit (200ug/m³)

Conclusions:

- VOC content can not be correlated to VOC emissions
- Impact: If used, TVOC levels may impact building clearance testing



Financial Impact of Poor Indoor Air Quality



- \$63 B/year loss from lost productivity and increased healthcare costs (National Energy Management Institute, 2010)
- 3% loss of productivity (OSHA report 1994)
- Estimated \$120B/year in litigation costs (US EPA)
- Cost of remediation/negative publicity
- 1.5 M out of 4.5 M US commercial buildings have unacceptable IAQ affecting 55M workers (US EPA and NEM 2010)
- \$76 B in 2008 to cover children's healthcare related to IAQ. (Health Affairs Magazine, May 2011)
- Number 1 reason tenants move: HVAC issues. (BOMA, 2010)



How Can We Enhance the Quality of Air We Breathe?

The IAQ Management Plan

- Design
- Construction
- Operations & Maintenance



Design



- Respond to site context
- Effective programmatic layout
- Proper ventilation design and zoning
- Low-emitting material specifications

Reasons why Sustainable Products aren't specified:

- “Green products do not have anywhere near the level of quality and durability of their “normal” counterparts”
- “They do not take into account Life Cycle Analysis (LCA)”
- Higher upfront costs; ROI stated but product data doesn't illustrate this
- Separating truth from fiction



Most commonly specified green products

(Courtesy: BDC Magazine June 2011)

- Paints and coatings
- Carpet and carpet tiles
- Flooring
- Adhesives and sealants
- Lighting products
- Insulation



Ranking of Factors as to Greenness

Durability	3.50	1 = not important
Low VOC emissions	3.11	2 = somewhat important
Formaldehyde-free	3.06	3 = very important
Life cycle cost	2.98	4 = extremely important
No VOC emissions	2.90	
Recycled content(post)	2.86	
Recycled content(pre)	2.83	
Recyclable/compostable	2.81	
LCA	2.75	
Rapidly renewal material	2.71	
Biodegradability	2.61	
Total VOCs (TVOC)	2.59	
Carbon content	2.49	
3 rd party certification	2.45	
PVC free (no vinyl)	2.22	
Phthalate emissions	2.20	



Where can I find guidance?



- Pharos Project: rates products according to hazard concerns and renewable content.
- Green Spec Product Guide—Run by Building Green since 1997, evaluates top sustainable products by building sector
- Green Format: CSI's listing of product attributes; does not screen for environmental friendliness.
- NAHB RC Green Approved Products: lists products that contribute to points in its rating system
- Practice Greenhealth EPP Guide

The Importance of Air Quality in Building Codes and Standards

- International Green Construction Code (IgCC)—March 2012: Chapter 8
- ASHRAE 189.1 – 2009: Chapter 8
- Collaborative for High Performance Schools—2002: Section 2.2
- NAHB National Green Building Standard (ICC 700) 2008: Chapter 9
- CALGreen—2011; Section 4.5 Residential and Section 5.5 non-residential



Sustainable Product Standards you can use TODAY.....



- California DPH Section 01350 required in:
 - NSF 140 Carpet
 - NSF 332 Resilient Flooring
 - ULE 100 Gypsum
 - ULE 102 Doors
 - ULE 105 Ceiling Tiles
 - ULE 115 Insulation

What is Section 01350 anyway?



Originally created for one specific environment in California. Expanded in 2010 by California Dept. of Public Health

- Full name: *Standard Method for the Testing and evaluation of VOC emissions from indoor sources using small scale environmental chambers*
- Covers 35 individual chemicals of concern when there are over 13,000 that emit from man-made products
- Only fits office and classroom building scenarios
- Product size and numbers not identified in the standard



IAQ v. Carbon Footprint...or things I tell people I care about...

- Energy efficiency has collided with human health
- Most Sustainable programs emphasize energy conservation; water consumption/ waste reduction
- Credit categories heavily weighted as above
- Human health aspects not equally valued as integral to sustainable buildings
- These policies are being adopted by many US laws and regulations to our health detriment



Construction



- Wet before dry – beware the sink effect!
- Protect your ventilation
- Employ a moisture and IEQ manager
- Encourage good housekeeping amongst all onsite workers
- Pre-occupancy Indoor Air Quality Test

Operations & Maintenance



- Green procurement guidelines
- Establish a high performance cleaning program
- Educate staff on green housekeeping procedures
- Establish regular HVAC and moisture management plans
- Perform regular IAQ testing

A Tale of Two Buildings



Building 1



Building 2

The Facts

Owner: State of Washington, Department of Natural Resources

New Construction

Indoor Air Quality Prioritized:

- Proper installation sequence for materials
- Temporary ventilation during construction
- Low-emitting materials specified
- Indoor Air Quality testing before occupancy



Building 1

The Facts

Owner: Private,
Atlanta Telecommunications
Company

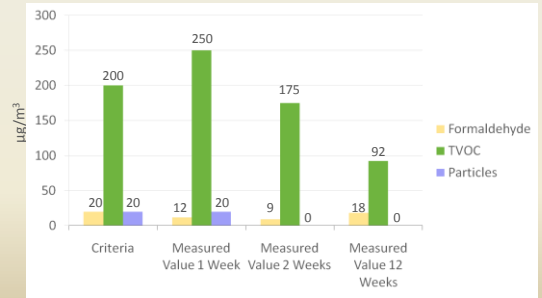
New Construction

Indoor Air Quality was not
prioritized

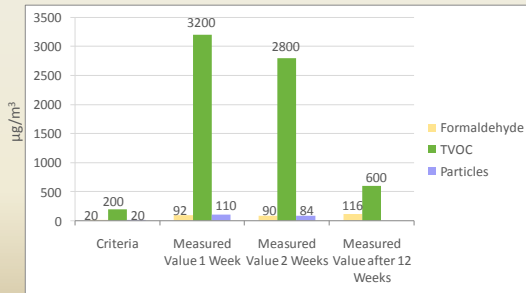


Building 2

Levels Taken for Building 1



Levels Taken for Building 2




Indoor Air Quality and
Sustainable Design

Indoor Air Quality and LEED



LEED BD&C/ID&C

- Indoor Environmental Quality = 15% of potential points
 - Ventilation - 1 pt
 - Source Control - 8pts
 - 50% of points are for low-emitting materials



Low-Emitting Material Credits:


- 4.1 Adhesives & Sealants
 - SCAQMD, GREENGUARD Children & Schools
- 4.2 Paints & Coatings
 - Green Seal, SCAQMD, GREENGUARD Children & Schools
- 4.3 Flooring Systems
 - CRI Green Label Plus, GREENGUARD Children & Schools
- 4.4 Composite Wood & Agrifiber
 - No added urea-formaldehyde
- 4.5 System Furniture & Seating
 - GREENGUARD Children & Schools

LEED and IAQ issues Credit attainment Survey

(GEI Survey: August 2011)

LEED Rating System: IAQ related Credits	% Not Achieved	Reason for non attainment
3.2 IAQ Testing Before Occupancy	40%	TVOC levels
4.1 Adhesives/ Sealants	10%	Content
4.2 Paints Coatings Coverings	6.7%	Content
4.3 Flooring Systems	11.7%	Emissions
4.4 Composite Wood / Agrifiber	47%	Content of Formaldehyde
4.5 Furniture/ Furnishings	55%	Emissions

EQ Credit 3.2: IAQ Testing before Occupancy: Attainment Best Practices



- Paths: Flush-out of building OR perform air testing
 - Flush out usually more expensive ; 14,000 cu. ft/sq ft of floor area (outdoor air)
- IAQ Testing: Prepare, Coordinate, React
 - Specify Low Emitting products when possible
 - Use EQ Credit 3.1 Construction IAQ Mgmt Plan during Construction
 - Vigilance and common sense must be followed, Ex: Failures result from touch up painting right before the 4hour test
 - Use only qualified LEED professionals and consultants to perform
 - React in case of failure: test takes 4hours, results delivered within 1 week
 - Report should comply with LEED Online project documentation

This concludes the AIA portion of the presentation.

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Improving human health and quality of life by enhancing indoor air quality and reducing people's exposure to chemicals and other pollutants.

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Voluntary Certification Process:

1. Manufacturer contacts GREENGUARD
2. Product Profiling & Testing
3. Full Chamber Testing
4. Quarterly Monitoring and Annual re-testing of product

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Third-Party Certification Provides:

1. Assurance that products are low emitting
2. Verification of due diligence
3. Identification of products as a contributor to enhanced indoor air quality

Printable Certificate

Shows Program Requirements and Chemical Levels not to exceed

Acceptable for credit compliance in sustainable building programs.



We are an environmental resource.

www.greenguard.org

For the world's largest online, low-emitting product guide



Resources for Indoor Air Quality



www.greenguard.org

www.sinsofgreenwashing.org

www.aerias.org

www.epa.gov/iaq

www.lungusa.org/air/air_indoor

www.usgbc.org

www.chps.net

www.nahbgreen.org

Learning Assessment

1. What is a VOC? What is TVOC?
2. Name 3 types of pollutants in the indoor air we inhale every day
3. How do these pollutants affect our health?
4. How do these pollutants affect the building?
5. When in the building life cycle must Indoor Air Quality be considered: design, construction, or operations & maintenance?

Learning Assessment (cont'd.)

6. Why is California DPH Section 01350 inadequate in assessing emissions?
7. List 3 resources to evaluate the "greenness of a product"
8. A product that is low content VOCs is always low emitting of VOCs. T or F?
9. The International Green Construction Code is an example of a high performance building program similar to the LEED program. T or F?
10. You can trust the Government to make sure only safe products are available for use. T or F?

Questions?



Healthy Indoor Air Quality by Design