Workshop W9

Wednesday, November 4, 1:30–3:00 p.m. and 3:30–5:00 p.m.

REDUCING THE RISK OF CONSTRUCTION DEFECTS ON GREEN PROJECTS

Presented by

George H. DuBose
Vice President
Liberty Building Forensics Group®

Building "green" is the fashionable trend, but it also introduces some inherent construction risks that may increase the potential for construction defects. By identifying and understanding the nature of these "hidden" technical risks before beginning the project, contractors, owners, architects, and insurance companies can minimize the likelihood of an unpleasant, time-consuming, and costly construction defect claim. This workshop outlines the hidden technical risks in green projects that create, or expand, the chance of failure for certain aspects of the project.

George H. DuBose

Vice President
Liberty Building Forensics Group®

Mr. DuBose is presenting Workshop W9, "Reducing the Risk of Construction Defects on Green Projects," on Wednesday afternoon. He is a Certified General Contractor and building performance and construction expert with Liberty Building Forensics Group in Orlando, Florida. He is a general contractor and forensic building specialist with 18 years of experience solving building problems. Mr. DuBose has published three manuals, including the NCARB monograph on moisture and mold prevention. Currently, he is on the project committee that is producing an advanced IAQ Design Guide Manual. The project is being sponsored by AIA, BOMA, EPA, USGBC, and ASHRAE.

He is currently providing consulting services on multiple green building projects. His areas of technical expertise include moisture intrusion investigation, HVAC system performance, building envelope/rainwater assessment, litigation support, and moisture assessments.

Notes

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Reducing the Risks of Construction Defects on Green Projects

George H. DuBose, CGC

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Premises of the Presentation

- Building green is a noble goal
- Risks – Some are obvious but most are obscure.
- Failures range from acute to chronic
- "Good practices" have not been well integrated

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Supercharged is not High Performance

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5 Factors in Green Building Risks

1. Increased Risk of Construction Deficiencies
2. Pressure to do green construction with no price premium
3. New and innovative product performance risks
4. Codification of green ratings systems
5. Emerging requirements for long-term performance guarantees

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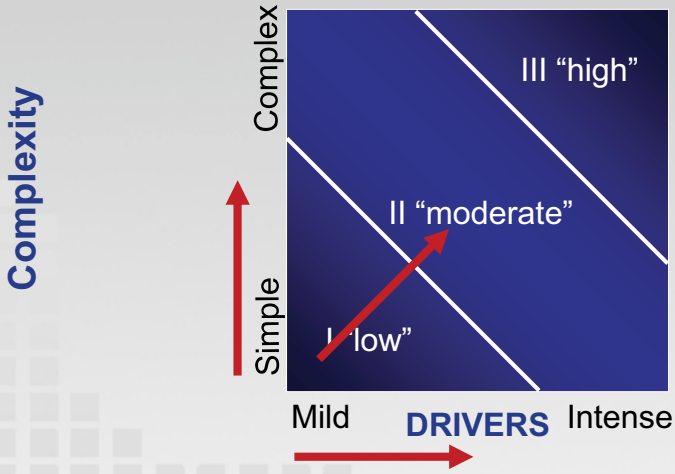
Complex Building + Strong Drivers = "High Risk" Buildings



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Source: 1996 Florida Solar Energy Center (FSEC) Study.

Technical Risks for Green Buildings

Green Buildings vs. Low Risk Buildings

Green Buildings	Low Risk Buildings
More Outside Air (>ASHRAE by 30+%)	Minimum Outside Air (Does not exceed ASHRAE)
Emphasis on energy conservation	Emphasis on humidity control
Stresses VOC reduction --Emphasizes exhaust (>5 Pa) --Promotes building flush-out	Minimal VOC concern --Very tight control of exhaust --Rejects building flush-out
Stresses new, innovative materials	Stresses proven materials
Carbohydrate based materials	Hydrocarbon based materials
Stresses extra envelope insulation	Stresses drying potential of envelope (walls and roof)
Minimally addresses air barriers	Stresses air barriers

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FACTOR 1: Protection Against Risks for Increased Construction Defects

1. Compare the building to the risk table
2. Identify the green objectives and rate them for increased risk
3. Develop risk and QA management plan targeting those higher risk objectives

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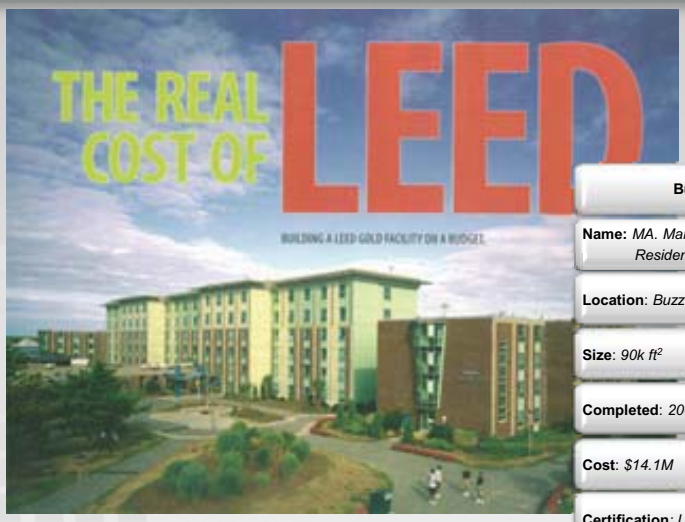
FACTOR 2: No Premium for Green Buildings



Building at a Glance

Name: *MA. Maritime Academy Residence Hall*

Location: *Buzzards Bay, MA.*

Size: *90k ft²*

Completed: *2007*

Cost: *$14.1M*

Certification*: LEED® Gold*

Source: April 2009 issue of ***ED+C*** magazine

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Energy and Atmosphere: LEED® Points

Points	Item	Cost	Comment
0	**Prereq. 1: Fundamental Commissioning**	**$22,000**	**Cost of independent commissioning agent**
0	Prereq. 2: Minimum Energy Performance	$0	Basic energy-code requirements
0	Prereq. 3: CFC Reduction	$0	Basic code requirement
10	Optimize Energy Performance	$641,120	Prescriptive approach and minimal system requirements
3	On-site Renewable Energy	$8,000	100% of electricity required by building provided by photovoltaic array and existing wind turbine
1	**Additional Commissioning**	**$8,000**	**Cost of independent commissioning agent**
1	Ozone Depletion	$0	No refrigerants utilized

Source: April 2009 issue of ***ED+C*** magazine

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Indoor Environmental Quality: LEED® Points

Points	Item	Cost	Comment
0	Prereq. 1: Minimum IAQ performance	$0	No cost – basic code requirement
0	Prereq. 2: Tobacco Smoke Control	$0	No cost to prohibit smoking at a campus facility
1	IAQ Management Plan: Construction Phase	$0	No real cost, just best construction practice
1	IAQ Management Plan: Occupancy	$500	Estimate for energy costs during flush-out procedure before occupancy
1	Low-Emitting Adhesives and Sealants	$0	No real costs – now readily available
1	Low-Emitting Paints and Coatings	$0	No real costs – now readily available
1	Low-Emitting Carpet Systems	$0	No real costs – now readily available
1	Chemical and Pollutant Source Control	$500	Added costs for MERV 13 filters
1	Controllability of Perimeter Systems	$0	No real cost due to dormitory room layout. Switch on room wall and operable windows.
1	Daylight & Views: Views for 90%	$0	No cost due to dormitory room layout

Source: April 2009 issue of ***ED+C*** magazine

FACTOR 3: Product Performance Risks

Green Buildings vs. Low Risk Buildings

Green Buildings	Low Risk Buildings
Stresses innovative materials	Stresses time-tested, proven materials
Renewable/carbohydrate based materials	Hydrocarbon based materials
Stress extra envelope insulation	Stress drying potential of envelope (walls and roof)

"New materials are unproven by definition. Like most experiments they tend to fail. If the experiment is the whole exterior of the building [*or the entire HVAC system],* they fail big."

Quote from

"How Buildings Learn: What happens after they're built"

by Stewart Brand

Risks Associated With New Materials

Challenge: Understanding performance of new materials and systems in high risk areas of envelope assembly

- Vapor retarder vs. air barrier vs. secondary rainwater barrier
- Dew point location
- Interrelationship with HVAC
- Transitions and terminations
- Interaction with other materials-compatibility
- Moisture Absorption

New Bio Based Insulation

Video Open Cell Insulation_edited.avi

Innovative Green Products

- If unfamiliar with new material's individual performance….
  …probably know less about material's interaction with other components
- Recognize additional risk in innovative products….
  …and apply higher degree of rigor in evaluation

There's one sure way to kill an idea: Sue it to death."

July 14, 2008 ENR article

"In design engineering there are two resources available: The laws of physics and the products of the market. The designer of excellence works with the former and the designer of mediocrity works with the latter."

Quote: Kevin Dickens/Jacobs Corp.

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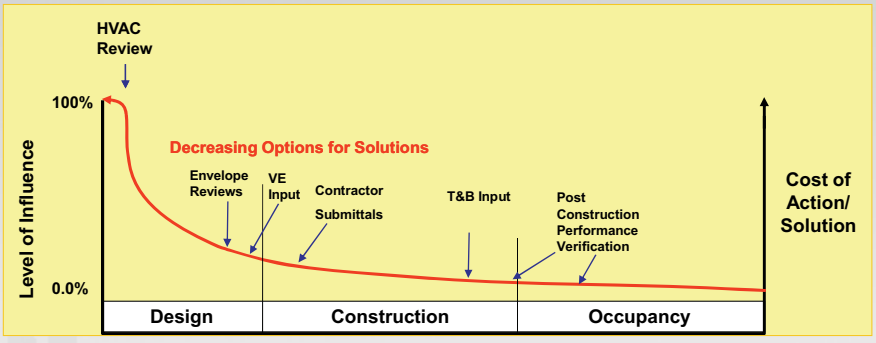
Elements of a Comprehensive Peer Review Plan



Source: Adapted from Quality in the Constructed Project, American Society of Civil Engineers, 1988.

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What a Peer Review Is

1. Inserting SME into the process
2. Mirrors the healthcare industry
3. Green drives need for SME on products

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What a Peer Review Is NOT

1. Additional insurance policy
2. Contracted to Owner
3. Requested by any project team member
4. Does not replace LEED Consultant

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Every Task Has Responsibility Matrix

1. Primary Responsibility
2. Advising or Assisting Responsibility
3. Reviewing Responsibility

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FACTOR 4: Back Door Codification

Draft

ASHRAE® Standard

Proposed Standard 189.1P,
Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

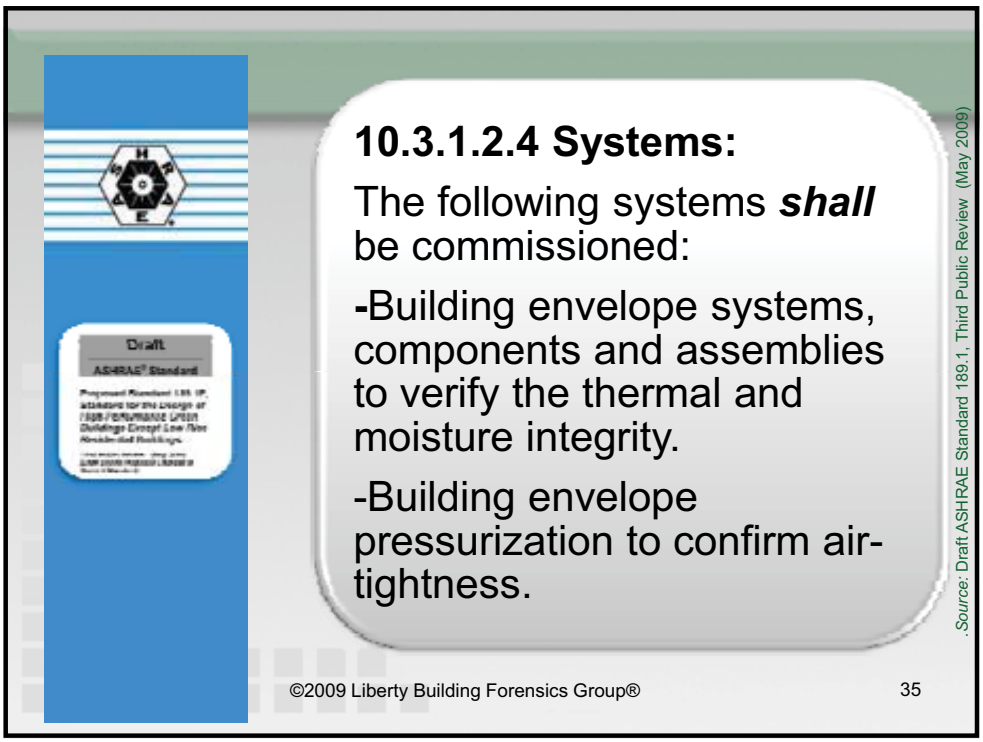
Third Public Review (May 2009)
(Draft Shows Proposed Changes to Current Standard)

Source: Draft ASHRAE Standard 189.1, Third Public Review (May 2009)

10.3.1.2 Building Project Commissioning:

A commissioning process shall be incorporated into the pre-design, design, construction, and first year occupancy of the building project that verifies that the delivered building and its components, assemblies, and systems comply with the documented owner's project requirements.

Source: Draft ASHRAE Standard 189.1, Third Public Review (May 2009)



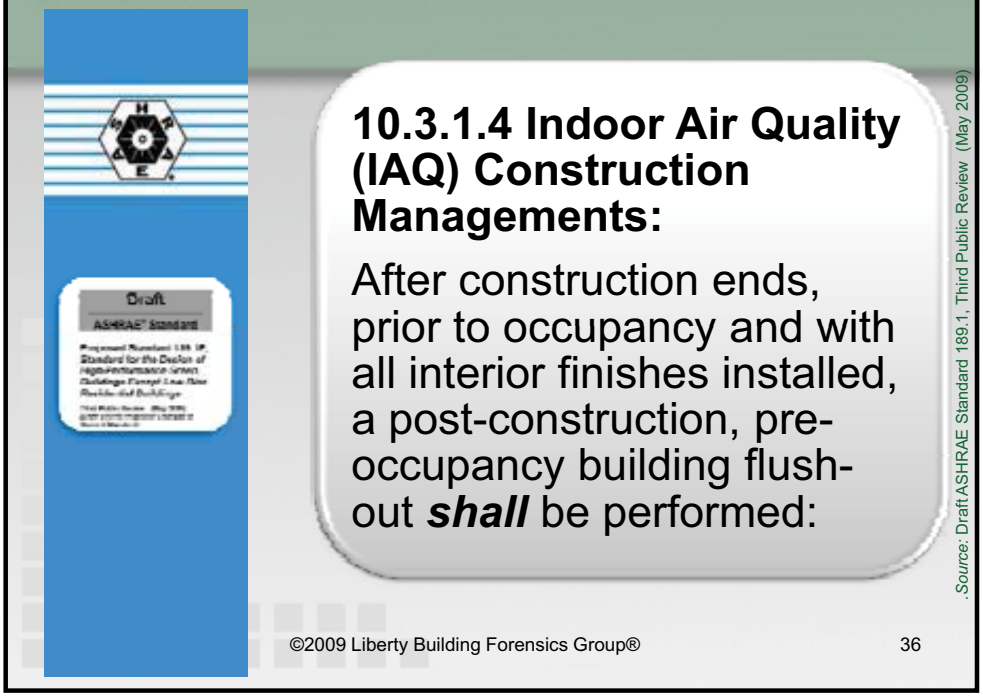
10.3.1.2.4 Systems:

The following systems ***shall*** be commissioned:

-Building envelope systems, components and assemblies to verify the thermal and moisture integrity.

-Building envelope pressurization to confirm air-tightness.

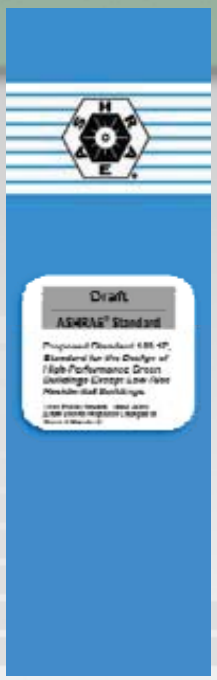
Source: Draft ASHRAE Standard 189.1, Third Public Review (May 2009)



10.3.1.4 Indoor Air Quality (IAQ) Construction Managements:

After construction ends, prior to occupancy and with all interior finishes installed, a post-construction, pre-occupancy building flush-out ***shall*** be performed:

Source: Draft ASHRAE Standard 189.1, Third Public Review (May 2009)



2. Continuous Post-Construction, Pre-Occupancy/Post-Occupancy Flush-out:

If occupancy is desired prior to completion of the flush-out, the space is allowed to be occupied following delivery of ***half of the total air changes***

Source: Draft ASHRAE Standard 189.1, Third Public Review (May 2009)

Green Buildings vs. Low Risk Buildings

Green Buildings	Low Risk Buildings
More Outside Air (>ASHRAE by 30+%)	Minimum Outside Air (Does not exceed ASHRAE)
Emphasis on energy conservation	Emphasis on dehumidification
Stress VOC reduction --Emphasizes exhaust (>5 Pa) --Building Flush out --Low VOC material selection	Minimal VOC concern --Very tight control of exhaust --Rejects building flush out --Agrees w/low VOC materials

Indoor Environmental Quality

Minimum IAQ Performance & Increased Ventilation

Intent: Meet ASHRAE 62.1-2004 ***and***

Provide additional outside air ventilation to improve indoor air quality for occupant comfort, well-being and productivity

Requirements for Mechanically Ventilated Spaces:

Increase breathing zone ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Std. 62.1-2004.

Construction IAQ Management Plan: Before Occupancy

Requirements:

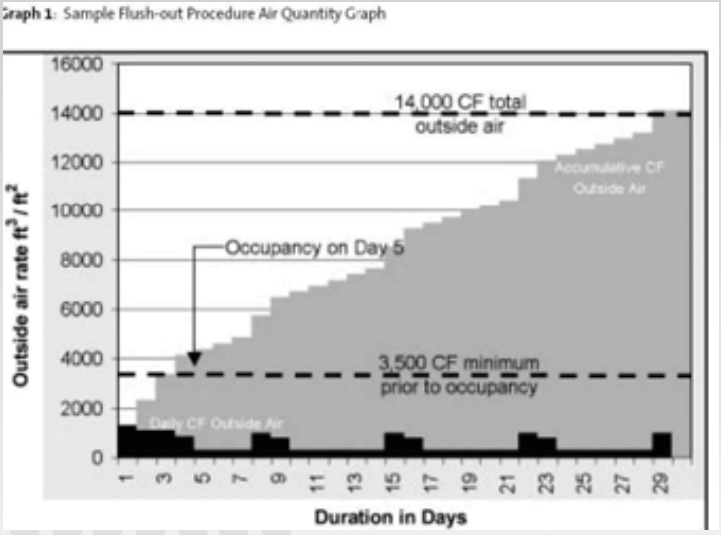
Option 1--Building Flush Out

Prior to Occupancy-Flush-out prior to occupancy with 14,000 cf of outdoor air/sq ft of floor surface area

or

Occupied-Partial flush-out prior to occupancy (3,500 cf/sf) and remainder of flush out occurring primarily during unoccupied periods

Sample Flush Out Procedure from LEED 2.2



FACTOR 5: Emerging Green Building Requirements

1. Owner's commit to sharing use data (energy/water)
2. LEED certification can be revoked
3. Third parties can initiate USGBC non-compliance action

121 Building Study by USGBC

nbi
new buildings

PO Box 2349
White Salmon, WA 98672
509-493-4468

1331 Washington Street
Vancouver, WA 98660
360-567-0950
www.newbuildings.org

Energy Performance of LEED® for New Construction Buildings

FINAL REPORT *March 4, 2008*

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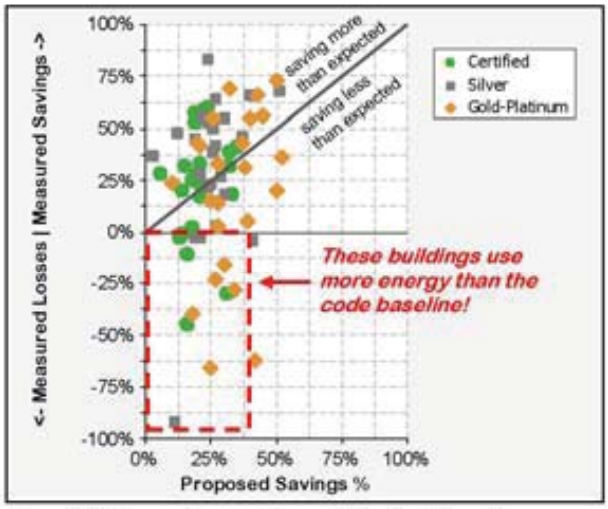

Figure 20: Measured versus Proposed Savings Percentages

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Conclusions

- Green building risks can be predicted by knowing the complexity and driver status of the building
- Perform multiple technical peer reviews during design focusing on:
  - --Predicting interaction of the various building systems
  - --Predicting the building's post-construction performance
  - --Analyzing the envelope performance
  - --Design team must incorporate the "best practices" in the fields of waterproofing, humidity control, and building envelope performance.

Conclusions

- Designers & contractors must place regionally-specific climate criteria ahead of LEED credits
- Closely analyze new products touted as "green" or innovative, especially products used in the HVAC and building envelope systems. Carefully review warranties, disclaimers, length of in-service testing, and data sheets.
- Development of a Green Building Risk Management Plan to address high risk areas
- Energy consumption/prediction is not well understood and some LEED buildings will not perform as predicted