The Hidden Risks of Green Buildings: Why Moisture & Mold Problems are Likely

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The great irony of building green is that the very concepts intended to enhance a building's performance over its entire lifetime are many of the same things that make a building highly susceptible to moisture and mold problems during its first few years of operation.

While green buildings have many positive benefits, there is also strong evidence to suggest a direct correlation between new products/ innovative design and building failures. Simply put, departing from the "tried and true" often means increasing the risk of building failure.

Two strong characteristics of most green buildings are: 1) the use of innovative, locally-produced products and 2) the implementation of new design, construction, and operation approaches that are intended to reduce energy usage and be environmentally sound.

Green Buildings vs. Lower Risk Buildings

Green Buildings	Lower Risk Buildings
***Adds additional* outside air (>ASHRAE by 30+ %)**	***Minimizes* outside air (Does not exceed ASHRAE guidelines)**
Emphasize energy conservation	**Emphasize dehumidification**
Stress VOC reduction --Emphasizes exhaust (>5 Pascals) --Building flush out	**Minimizes VOC concern** --Very tight control of exhaust --Rejects building flush out
Stresses new, innovative materials	**Stresses proven materials**
Stresses carbohydrate based materials	**Stresses hydrocarbon based materials**

Stresses extra envelope thermal insulation	Stresses drying potential of envelope (walls/roof)

The preceding graphic summarizes some of the differences between green buildings and the concepts the authors have found in lower risk buildings. For example, lower risk buildings do not exceed industry guidelines on mechanically introduced outside air; but emphasize humidity control (especially in more humid climates). Green buildings, on the other hand, reward the introduction of more outside air than current industry standards, which can lead to indoor humidity problems and mold growth.

The intent of building green is unquestionably noble and good, and should be aggressively pursued. However, because of the dramatic change that this will present to the design and construction industry, its implementation will present new risks that are likely to be both legal and technical in nature.

Some of the legal risks are fairly obvious, such as the risk of not meeting a building owner's expectation of achieving a certain level of LEED® certification (i.e., implied or even written warranties). Other risks are more obscure, such as:

o Accepting the higher standard of care that a green building might present—what is currently considered "best practices" may now become the new expected "standard of care." Most insurance companies exclude anything that exceeds the normal standard of care.

o Failing to recognize (or prepare for) the unknowns in cost and schedule impacts that a green building might present.

o The failure of new products to meet their promoted performance levels, which is more likely with new materials compared to proven materials found in traditional buildings.

Open celled foam insulation such as the above photograph depicts (especially materials that are bio-based) is being heavily promoted as green products and is often described as hydrophobic. The fact is that most of them are highly moisture absorbent. This is demonstrated in a crude experiment which shows the amount of water absorbed over a short period of time. These materials have a high potential for hiding moisture problems and decreasing the drying potential of envelope cavities—both potentially severe problems in buildings.

Examples of Technical Risks for Contractors & Designers

Moisture intrusion, whether bulk water intrusion through the building envelope or a relative humidity increase due to the heating, ventilating, and air conditioning (HVAC) system, results in a large percentage of construction claims in the U.S. Sustainable building practices, some of which are part of the LEED® accreditation process, can increase the potential for moisture intrusion if not carefully considered and implemented. Examples include:

o Vegetative roofs, which are more risky than conventional roofs (due to the constantly wet conditions) and must be carefully designed, constructed, and monitored after construction.

o Improved energy performance through increased insulation and the use of new materials, which may change the dew point location in walls, resulting in damaging condensation and a reduced drying potential for wall assemblies. Lower risk buildings emphasize the drying potential of the envelope over increased insulation.

o Reuse of existing buildings or recycled components, which may not be easily integrated to the adjacent new materials and could cause compatibility problems between these materials.

o Use of new green construction materials that have not been field-tested over time. The designer needs to assess new materials and their risks compared to traditional materials found in lower risk buildings.

o Increased ventilation to meet indoor air quality (IAQ) goals that may unintentionally result in increased interior humidity levels in hot, humid climates.

o Building startup procedures, such as "building flush out," which could result in increased humidity levels and mold growth. Lower risk buildings rely almost exclusively on source control (which is also a green building goal) rather than relying on "flush-out" and increased building exhaust.

New green construction materials **are** entering the market at a staggering rate. Because many of these products help to achieve multiple LEED® credits, designers working on green buildings are eager to specify these materials. The risk to contractors is that many of these new items are not time-tested, and designers often do not have the time to fully research their efficacy. If the new product fails, it may be difficult to determine if it is a design error, an installation error, or a product defect. Additionally, contractors must rely on subcontractors to install new materials that they are inexperienced in installing.

Conclusions

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

Quote from *ENR,* July 2008

What is the greatest risk to the green building movement? It's likely not the increased costs associated with green buildings—it's more likely green buildings that don't perform up to expectations and, in some cases, may experience significant failures.

The increased costs of litigation and insurance that could result from underperforming green buildings will be absorbed by designers and contractors (in a highly competitive marketplace). However, most likely these costs will be passed onto building owners in the form of change orders.

Only recently has the marketplace begun to recognize the various contractual, legal, and technical risks that are inherent to green buildings. A growing number of experts have suggested that the first two steps to improved green building risk management are to: 1) Recognize the unique risks for green buildings. 2) Develop a set of guidelines that merge the unique regional challenges with green building guidelines, recognizing the lessons learned in lower risk buildings.

The design and construction community must not assume that if you build green then you will automatically be building regionally correct or even a lower risk building. Until the gaps between lower risk buildings and green buildings are addressed, the design and construction community would be advised to prioritize the already learned lessons of lower risk buildings of the waterproofing, humidity control, and building forensics community. Without these priorities, poorly functioning green buildings are the likely result, and this could be the ultimate killer for the green building movement, especially in demanding climates.

Liberty Building Forensics Group, LLC (www.libertybuilding.com) is a firm that specializes in forensic building investigations and expert

witness/litigation support. Its staff has led the correction and cost recovery for some of the largest building failures in the country, including the $60 million defect claims at Hilton Hawaiian Village in Honolulu and the $20 million Martin County Courthouse problems. Its staff has performed green building-related services on over $3 billion in new construction since the late 1990's and has authored three manuals and over 100 technical publications.

The entire technical article that served as the basis for this condensed version can be found on the Liberty Building and on the NCARB.org websites.

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