The Single Most Important Factor in Reducing the Risk of a Mold and Moisture Lawsuit on Your Next Project

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Introduction - Have We Lost our Minds?

Not all buildings are created equal; in fact, some fail at alarming rates, often soon after being commissioned. Many failures occur at a high rate of frequency but result in minor, practically negligible consequences. Others, however, while low in frequency, lead to catastrophic results such as significant mold and moisture problems.

Consider the Hilton Kalia Tower, which experienced a $60M mold and moisture problem that closed the Tower for nearly two years so that remediation and corrective measures could be performed. LBFG staff, including George DuBose and David Odom, were the principal investigators for causation and managed the remediation design.

If the Tower had undergone a peer review for mold and moisture-related risks, this problem could have been prevented. Mold and moisture peer reviews target potential areas of failure that can occur in the design and construction phases of the project. One common trouble spot is the interrelationship between the HVAC system and building envelope design and performance. In the case of the Kalia Tower, the combination of HVAC and wind-induced outdoor air infiltration, along with both planned and unplanned building envelope, caused significant amounts of air to enter the guest rooms. The unexpected air flow overwhelmed the ability of the FCU to not only provide proper pressurization, but also to provide sufficient dehumidification, resulting in moisture-related mold in walls and on the furniture, fixtures, and equipment.

A mold and moisture peer review is specifically designed to address these kinds of issues that are so often overlooked. The root of the matter is that too many architectural and mechanical designs are completed in silos, and then during construction, contractors are not able to identify key building performance problem areas before they result in building-wide damage.

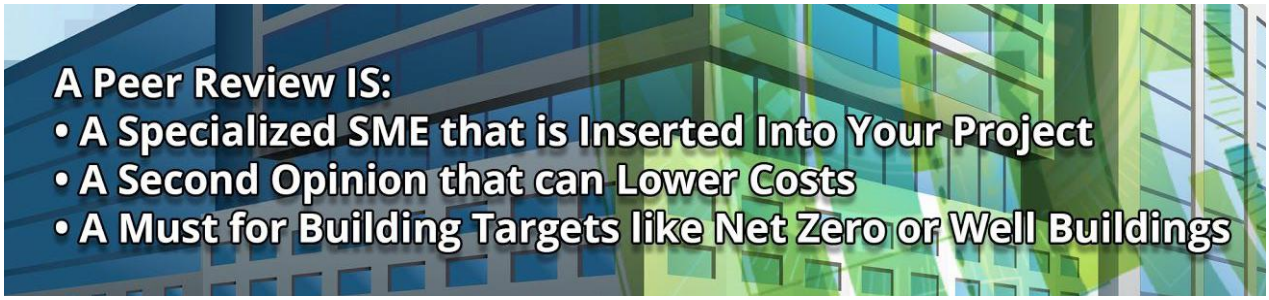
What is a Peer Review (and What it is Not)

When it comes to catastrophic mold and moisture building failures, the design and construction industry uses litigation as its primary feedback system. This is unfortunate, because it reflects a failure to understand that good building performance starts early and is continuous throughout the design, construction, and operation processes. Instead, a peer review should be done early on, building a bridge across the gap that often exists between what building designers and contractors know and what they need to know. This tool also serves to improve the communication between architects and mechanical engineers.

A peer review is basically introducing a subject matter expert (SME) into the design and construction (D&C) processes. The SME helps to ensure that the right people get the right information at the right time. There has been resistance to peer reviews in the D & C community because at face value, they appear to add an extra

layer of consultants and unnecessary additional expenses that can only make the overall cost of the project go up. Interestingly, however, other industries such as healthcare have learned that second opinions (i.e., peer reviews) actually lower costs and make for better decision-making. An SME has the experience and knowledge to be confident that there are less-costly options that can still achieve the desired project results. Peer reviews in the D&C process have been shown to keep costs in check, especially in view of the tendency of architect and engineering practitioners who take a "belt and suspenders" approach to their building design in an effort to ensure that a mold and moisture problem does not occur.

Considering the emergence of today's green products that have flooded the marketplace, and with pressure on the design community to adopt different design and construction strategies in order to achieve targets like Net Zero or WELL Buildings, it is more important than ever to include peer reviews as a part of each new project. Popular green products, often without proven field testing, have introduced new risks into the D&C process that have perhaps never been seen before. Our buildings have become laboratories for product experiments initiated by manufacturers clamoring to get their product to market and to gain market advantage in today's climate change arena. "New products [or design ideas] are experiments…," Stewart Brand so aptly put, "and experiments are intended to fail. If they are the whole building envelope [or HVAC system], they fail big."



After the Hyatt Regency pedestrian walkway collapse in 1981, the American Society of Civil Engineers (ASCE) set out to study why this structural failure occurred. They found, amongst other things, that it was in fact a process failure as much as it was a design and construction failure. Changes had occurred during the shop drawing phase that did not allow for the structure to satisfy the structural design intent. This failure in process, according to the ASCE's *Quality in the Constructed Project* and *Project Peer Review Guidelines* manuals, meant that there had to be a change in how peer reviews were requested. Historically, peer reviews had been a top-down decision made by the owner or at times by the architect, but never by the general contractor and certainly never by a subconsultant or subcontractor. The ASCE found that this mindset needed to change, and recommended that on any project, any project team member can and should be able to request a peer review. In our experience, this is especially true in the world of mold and moisture building failures because of the unique cross-disciplinary decisions that impact building performance and can determine if your next project will successfully avoid mold and moisture problems.

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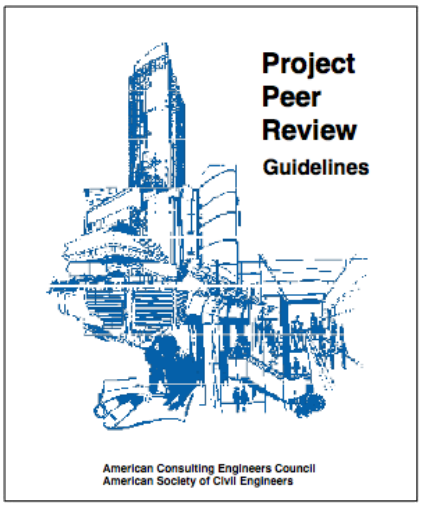
Don't make a peer review something it isn't[1]



A peer review is not an extra insurance policy for your project. In fact, if you saddle the peer reviewer with high liability exposure, then the project will not gain the fullest benefit from this exercise. A peer review must be able to opine on matters of the project performance for the benefit of the project. This can only occur when the peer reviewer is not burdened with the possibility of high liability exposure for those opinions. It most cases, opinions by the peer reviewer are extremely reasonable and in fact often, if not always, more reasonable than if those decisions had been left to the architect or mechanical engineer. As an SME, the peer reviewer comes to the project with a highly specialized background, so the opinions provided are generally less expensive and less onerous on the project. This is due to the SME's ability to provide recommendations that don't take a "belts and suspenders" approach, whereas the architect and mechanical engineer, who likely don't have the degree of specialization that the peer reviewer does, will be more inclined to take a "safer" approach resulting in higher costs and a greater burden on the project. The peer reviewer can with confidence only recommend what is needed for a successful project, without including unnecessary redundancy that increases costs on a project.

The individual or entity for whom the peer reviewer works is critical. In too many instances the peer reviewer contracts with the wrong project team member, leading to suppressed opinions because the "truth" will impact the redesign too

[1] Figure 1: Project Peer Review Guidelines by the ACEC and ASCE, was one of the first of its kind, was developed because of the tragic Kansas City Hyatt Regency Hotel pedestrian walkway collapse that killed over 114 people in 1981

much or because it was not anticipated in the negotiated bid. Instead, the peer reviewer should be contracted with the owner. This prevents suppressed opinions by allowing the peer reviewer to independently recommend what is best for the project free from the burden of going through the designer or contractor first. Of course the owner may still put pressure on the peer reviewer for other options, but within the peer reviewer-owner relationship, these options can be provided as best to less best options. After seeking input from the contractor and designer, the owner can then make a decision that incorporates a cost-performance analysis.

A peer reviewer is not a "detail checker" and does not replace other types of consultants such as commissioning or LEED consultants. There has been some confusion within our industry about the role of a peer reviewer as compared to the roles of other project consultants such as commissioning agents, constructability consultants, value engineers, LEED consultants, and quality control reviewers. A mold and moisture peer reviewer does not replace any of these other important roles.

"Undertaking the efforts of a moisture control technical peer review is, in our experience, a critical part of avoiding moisture and mold problems in hot, humid climates."

Where Problems Occur

The technical peer review efforts outlined in this e-book are the items we believe are most critical in avoiding catastrophic moisture and mold problems in warm, humid climates. This belief is based on our considerable experience with these types of problems in buildings throughout the Southeast U.S. Warm, humid climates offer a set of unique conditions that tend to dramatically increase the potential for moisture and mold problems in four distinct and specific areas: (1) building envelopes that are not sufficiently tight; (2) building envelopes that are not water-resistant; (3) an improperly sized air conditioning system coupled with improper dehumidification; and (4) inadequate building pressurization and infiltration control. Each of these factors brings a unique set of issues to the problems associated with moisture control.

At face value, these four items would appear to be very well understood by the design and construction industry. After all, a plethora of published information, training, and “how to” material exists to explain what these four items mean and what is required to avoid problems in these areas. Yet our firm repeatedly finds that these same issues are at the heart of some of the largest and catastrophic mold and moisture problems in the world. It would appear that the lessons learned from decades of advancement in understanding mold and moisture control in buildings have been somehow lost, and we find ourselves starting all over again. This industry amnesia about what works and what does not work has become one of the greatest challenges facing the design and construction community today. The institutional knowledge of so many construction and design firms has vanished along with departing legacy partners.

Download Our "Design and Construction Amnesia" Article Now

Factor One: Building Envelopes That Are Not Sufficiently Tight

Conditions in a warm, humid climate mandate that the building envelope be constructed in a sufficiently tight manner so as to reduce the entry of humid air. Furthermore, all interstitial spaces within the building should be isolated from one another in order to prevent the inadvertent movement of any humid air that passes through the skin of the building. Building envelope tightness can be confusing to building owners, developers, designers, and contractors due to the fact that requirements for air tightness, air barriers, and the definition of what constitutes a sufficiently tight building are derived from a dozen-plus codes, industry standards, and guidelines. Furthermore, it can be difficult to test and determine whether a structure meets building tightness requirements, thereby increasing the risk of catastrophic moisture and mold problems in hot and humid climates. The challenge this presents is the reason why building envelope tightness should be a critical part of every mold and moisture peer review.

Factor Two: Building Envelopes That Are Not Water Resistive

Conditions in a warm, humid climate mandate that the building envelope be constructed in a manner that controls water in bulk form. This means that control must be such that the building envelope both prevents water from entering the building and also manages water that enters the envelope of envelope components so that it is directed and evacuated from the building. Water-resistance is not only about properly preventing water intrusion into the building; it is also about using materials that are durable and designing exterior wall systems that will dry properly. While these can be competing interests, they are essential to achieving a successfully water-resistant building envelope and avoiding a mold and moisture problem.

Factor Three: Incorrectly Sized Air Conditioning Systems and Improper Dehumidification

Designers historically tend to over-design air-conditioning systems so that occupants are able to achieve immediate comfort. While done with good intentions, this can actually create severe condensation problems by over-cooling, especially when moisture enters an envelope. The challenge in a warm, humid climate is to achieve maximum comfort levels with minimal humidity control costs due to energy consumption. This means more than just determining that a “unit is too big”; it’s about understanding what it takes to balance interior comfort with interior moisture control not only on peak design days, but also in part load conditions.

Factor Four: Inadequate Building Pressurization and Infiltration Control

The ability of make-up air systems to offset wind and moisture impacts is a common challenge in warm, humid climates. Achieving this balance requires that the envelope air barriers be carefully designed and constructed, and also that the HVAC system be operated within a well-defined range. Basic building pressurization is understood by many in the design and construction industry. However, what it

takes to achieve correct pressurization in every space and cavity in a building in order to avoid mold and moisture problems is not well understood. This is an element that requires both the architect and mechanical engineer to make the correct design decisions, followed by both the contractor and mechanical subcontractor implementing the design in a manner that achieves the desired goal. This cross-disciplinary area of concern is an important reason why a peer review should be required.

Elements of a Moisture Control Plan

Based on our firm's experience as well as that of the industry at large, we believe that the minimum requirements for an effective moisture control plan should consist of the elements discussed in this chapter. It should be noted that many of these elements are also requirements for certain green certification rating systems but are enhanced below to include humidity control in warm, humid climates.

Technical Peer Reviews

Several technical peer reviews of a project's design documents should be conducted for both rainwater intrusion, air infiltration, and humidity/condensation issues. Normally the most effective rainwater intrusion reviews begin at the 100% DD stage and are then conducted again at the 50% CD design stage when the envelope detailing is nearing completion but adjustments can still be made. A final review at the 100% CD stage is also important to confirm that the input was correctly implemented.

Likewise, good HVAC humidity/condensation reviews need to be conducted as early as possible while the HVAC systems are being designed, and then followed up in the late CD stage when the final controls are completed. All peer reviews should focus on identifying and preventing the most likely sources of moisture intrusion.

Quality Assurance (QA) Plan

The development of a detailed QA plan should be based on the results of the technical peer reviews by concentrating on the building components and systems that were identified as the most susceptible to rainwater intrusion and humidity problems. At a minimum, this QA plan should include detailed checklists, milestone "hold points," and documentation requirements.

Implementation of the QA Plan during Construction

This effort can be performed either by an independent outside consultant (with specialized moisture control expertise) or by the on-site staff with oversight by an outside moisture control specialist.

Commissioning of the Envelope and HVAC System

The start-up documentation and performance verification of the HVAC and energy-related systems are a requirement for a well-known green certification program and are good practice if moisture problems are to be avoided. The additional verification of the building envelope's performance is a moisture avoidance requirement if rainwater and air intrusion problems are to be reduced. In addition, startup and commissioning of both of these systems is critical in warm, humid climates because of the historical potential for moisture problems.

> "It is our opinion that fundamental commissioning (as defined by the USGBC LEED criteria) is not adequate by itself to avoid moisture and problems in warm, humid climates and should be enhanced by other procedures, such as detailed pressure mapping using micromanometers after startup."

First Cooling Season Performance Verification

A robust monitoring program to verify that proper humidity levels, water intrusion control, and energy performance requirements are met during the initial year's operation is important if moisture problems are to be avoided. This effort should be enhanced to include detailed monitoring of moisture conditions as well in warm, humid climates.

The above QA program contains many of the elements of the most predominant green certification requirements as well as good design and construction practices for warm, humid climates. It is our experience that these steps are necessary to reduce the probability of catastrophic moisture problems.

Moisture Assessment Design Peer Reviews

The following items should be included when performing technical design peer reviews:

- Review the HVAC systems for humidity control and building pressurization.
- Examine a model of the exterior envelope for vapor and air penetration (and condensation) potential.
- Review the rainwater intrusion details of the envelope (flashing, water resistive barriers, etc).
- Conduct peer reviews of the drawings and specifications, available design intent documents, and related design calculations that are provided by the design team at the time of each review.
- Include specific reviews of green products for good moisture control, which is now imperative due to green design and construction objectives.

The Building Enclosure Peer Review Areas of Concern

The following steps should be taken during a technical peer review:

- Review design details and written specifications to identify the most likely areas for rainwater intrusion (typically at wall component intersections, material transitions, and material termination points).
- Review the predominant wall systems to analyze location, likely performance, and permeability of vapor retarders, thermal barriers, and air barriers.
- Review the predominant wall systems to determine the likelihood of vapor entrapment and condensation.
- Identify the summertime dew point location in the predominant wall systems in comparison to the location of the air and vapor barriers.
- Review insulation materials and their placement within the thermal envelope of the predominant wall systems.

HVAC System Peer Review Areas of Concern

The review of the HVAC drawings and specifications should concentrate on the system design and its ability to control the moisture and mold problems typically associated with HVAC systems in warm, humid climates. Specifically, the peer review should assess the ability of the HVAC system to control the interior relative humidity levels and to retard the flow of moist outside air into the building (outside air infiltration).

Leaders in Moisture-Related Problem Avoidance

Hailed as the most sought-after building moisture forensics experts in the world, LBFG has conducted mold and moisture peer reviews that have resulted in over $6B in successful construction. From hospitals to hotels, multi-family residences to complicated commercial buildings, LBFG has helped business owners, developers, designers, and contractors all over the world to proactively prevent moisture intrusion problems by being able to spot and remove potential threats before negative issues ever manifest.

Walt Disney Corporation has retained LBFG staff since 1981 to assist with highly complex construction on over 400 projects worldwide. Only a firm that consistently exceeds expectations can serve for over 35 years as a consultant to such sophisticated building owners on some of their most demanding projects around the globe.

Focusing exclusively on building moisture problems for years has allowed LBFG to develop a deep understanding of which design and construction decisions generally result in building failure vs. success.

Sign up today for the LBFG Webinar: "The Predictability of Moisture Control & Building Air Tightness in High Performance Buildings."