Part 2

Hidden Risks in Green Buildings

By J. David Odom, Richard Scott and George H. DuBose

***Editor's Note:** Part one of this series (appearing in the December 2008 issue of Cleaning & Restoration) described how some Leadership in Energy and Environmental Design (LEED) credits have increased the potential for mold and moisture problems. One of the risk areas to watch is the interaction between the HVAC system and the building envelope, since a deficiency in either area can cause dramatic, building-wide moisture problems. This article will examine the issues of ventilation, IAQ management plans and indoor pollution sources.*

Although new wall system products are often intended to provide better thermal insulation, reduce air movement through the walls, or allow enhanced drying of the wall assembly (via vapor diffusion) they can also perform in unanticipated ways. These new products can dramatically change the way moisture flows through wall and roof systems and the potential for condensation within these cavities. The use of these new products mandate that the designer implement several additional steps to avoid problems:

1. Understand the performance characteristics of these new products. This may require a more rigorous evaluation of these materials than is required with traditional products. As with any product — but more so with new products — the performance answers may not be found in the product data sheets, but may require experiments and mockups to determine their performance. This type of evaluation may be beyond the scope and expertise of the design team, but it should nevertheless be implemented. In (Figure 3.4), a new insulation material (marketed for "green" buildings) was able to hold a considerable amount of water despite a data sheet that indicated it was a non-absorptive product. The use of this material in wall cavities could create massive mold problems if there is water leakage through the water resistive barrier, since the normal wet-dry cycling will likely not occur.
2. Analyze the vapor retarder, air barrier and bulk water retention properties to better understand where the material should be placed, if at all, within the wall system.
3. Model the wall systems for performance during the early design stages to predict the potential for water vapor transmission through the wall assemblies and potential for condensation to occur. Minimally, this modeling should predict the dew point location and the vapor transmission profile during the most extreme season for the location.
4. Perform a three-dimensional analysis of rainwater barrier geometry, especially at complex joints and changes in plane.

All other standard good practices for wall system design should continue to be followed whether new or traditional products are used including:

- The use of water resistive barriers as the first line of defense.
- Designing drainage planes to channel water down and out of the envelope.
- Installing secondary barriers for redundancy.
- Designing proper flashing and sealant joints.

Figure 3.4: Example of the amount of water absorbed by a wall insulation product. This experiment demonstrates that many products intended for wall and roof assemblies can absorb huge amounts of water in spite of their data sheets attesting to the opposite.

Increased Ventilation
(Environmental Quality Credit 2)

For decades there have been competing arguments within the mechanical design community on whether to increase or decrease the amount of outside air that is introduced into commercial and institutional buildings. Although there are sound arguments on both sides of the debate, today's emphasis on increased building ventilation to achieve LEED credits has given an added incentive to increase the amount of outside air to buildings. The experience of many forensic building experts (especially in the eastern half of the country) do not necessarily support the theory that adding more outside air creates a better performing, more sustainable building—sometimes quite the opposite (Figure 3.5).

What is known about ventilation air is that in regions with ambient high dew point conditions and elevated relative humidity levels (which include much of the entire eastern half of the country during portions of the year), there is a direct correlation between the number of moisture problems and increased rates of mechanical building ventilation. This can occur for obvious reasons, such as the additional moisture load that is introduced into the building along with the outside air. However, more obscure reasons can also increase the risk of adding outside air to a building. Unbalanced (or partially depressurized) buildings can be the result of moving large amounts of air around a building. When this condition occurs, moisture problems become more prevalent. These unbalanced conditions happen when air is trying to flow from the supply side of the air handler equipment to the return side, but is restricted by structural or architectural barriers.

Florida Solar Energy Center (FSEC) of Cocoa, Fla., called this condition the "Smart Air Syndrome," a concept that air is supposed to be smart enough to get from one place to another in spite of barriers. Additional ventilation air should always be designed in conjunction with considering the impact of the distribution of the ventilation air. This requires identifying parts of the building that could become depressurized with respect to outside conditions, thus potentially drawing humid outside air into the envelope cavity or occupied spaces. (Note: Even in less humid climates an

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