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MOISTURE MANAGEMENT IN BUILDINGS

by
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INTRODUCTION

"Mold is gold". That has become the favorite new phrase of many plaintiff attorneys, not to mention some restoration/remediation companies and a few forensic engineering firms. Mold claims are the hot new item, much like asbestos claims not too long ago. Most of the mold related assignments investigated by FORCON have involved an assessment of the extent of mold contamination resulting from a covered loss in a residence, usually a plumbing related leak, and the preparation of mold remediation plans.

As the following article indicates, there are various possible sources for the moisture that can bring about the growth of mold in buildings, many of which might not be covered by a typical property insurance policy or which might provide opportunities for subrogation. This is particularly true in the warm, humid climate in the southeast. Improper design, construction or maintenance can allow moist, humid air to be the source of moisture that molds need to grow. Unless these possibilities are adequately addressed in the mold investigation it could lead to an erroneous assignment of responsibility for the mold and, unless properly corrected, could result in the mold returning after it has been remediated.

THE MOISTURE PROBLEM

Water is one of the main ingredients for biological life. Most living organisms need a temperate environment, food and water. Without water, we humans would not exist. However, uncontrolled water in buildings not only creates problems for the building, but also for the human occupants.

Typical water damage in buildings comes from leaks in the water supply for bathrooms and kitchens. These leaks damage floors, walls and ceilings. In addition, furniture, fixtures and equipment can also be victims of water leaks. Each year, millions of dollars are spent to replace and/or repair building components damaged by interior water leaks.

There are other sources of water intrusion that are even more damaging then interior water leaks. More damaging because these sources can go undetected for months or even years. These undetected sources not only damage building components but they also become the water necessary for biological life in the form of mold and mildew. For mold and mildew to grow, they need food in the form of building components or dirt and dust. In the case of building components, the typical food sources are the cellulose paper on drywall, paste for wall coverings, wood and fabric.

Water can also come from outdoor water vapor, better known as humidity or moisture. This source of water can be the most damaging for the building and its occupants. Not only will water vapor damage building components and help grow mold and mildew, but it costs a great deal of money to remove the water vapor with the air conditioning system. And this energy cost goes on year after year. It is expensive enough to cool the building, but removing moisture from either the outside ventilation air or the indoor air can be up to 3 times more expensive to control and remove it from the building.

When mold grows it develops spores (similar to seeds), which can spread the mold to other parts of the building. These spores are extremely small in size and become an irritant to the upper respiratory system. In addition, mold when disturbed can break apart and also be spread to other parts of the building. And if these are not enough problems, molds also release VOCs (volatile organic compounds) when the mold grows or starts to die. These VOCs can also cause upper respiratory health problems, trigger asthma and be the source of immune response allergies. In extreme cases of immune compromised occupants, the effects can be disastrous, causing long-term illness.

Uncontrolled moisture resulting in high indoor humidity can also support viruses and bacteria. These disease-causing agents can come from many different sources, such as domestic water heating systems and humidifiers. Once formed or brought into the building, high moisture levels can help sustain them for extended periods of time.

SOURCES OF MOISTURE

There are many sources of moisture in buildings and not enough space in this article to cover them all. But I want to elaborate on a few of the building design mistakes that can contribute to high levels of moisture. If these design elements are not well understood by the building design professionals, then problems are sure to occur.

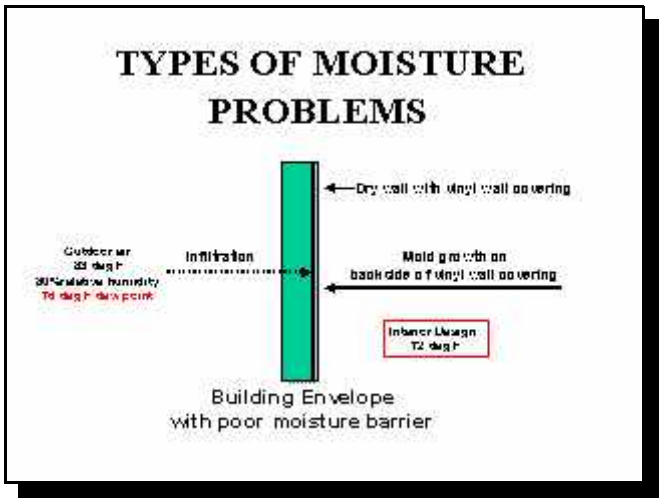
Moisture enters the building in a number of ways. The building envelope is a prime element of concern. Roofs, walls, windows and doors can leak outdoor air (infiltration) into the building. Also,

moisture can move across the walls by the difference in vapor pressure. The outside air during the humid periods of the year has a higher vapor pressure than the cool indoor building air. This higher pressure forces the moisture in the outdoor air to move across the building envelope. If this moisture condenses in the wall assembly (transforms into water as it reaches its dew point) and there is a food source, then mold will start to grow.

The design element that controls moisture movement is the building vapor barrier. The vapor barrier is a material that has a low permeability to moisture flow. Low permeable materials typically used in buildings are felt paper and building wrap. If the vapor barrier is improperly specified or constructed in relationship to the other adjacent building materials, then problems will occur.

Professional designers recognize that moisture cannot be completely stopped in today's modern buildings. A method of adequate moisture removal must be designed into the building envelope systems in conjunction with adequate capacity in the building's air conditioning system. This is important because the one building system that can remove moisture in a building is the air conditioning system. Therefore the design Architect and Mechanical Engineer must coordinate their efforts very closely.

Numerous examples of damage to buildings with poorly designed or installed vapor barriers have been reported by the news media. Typically these reports focus on the outcome of the poor vapor barrier in the form of stories that relate legal awards in the millions of dollars due to fungal growth. One that I commonly see in troubled buildings is vinyl wall covering (a very low permeable material) applied on the inside of exterior walls. The vinyl covering acts as a vapor barrier on the wrong side of the wall in humid climates. It traps moisture between the vinyl and the drywall that has a food source for the mold to grow on.



Another big culprit is building pressure management. As mentioned earlier, the building envelope can infiltrate outside air into the interior of the building if the building is not pressurized. This infiltration brings in uncontrolled air that contains fungus (mold and mildew), pollen and moisture. It is important that the design professional and the maintenance staff of the building understand building pressurization. Simply stated, building pressurization is the practice of bringing in more ventilation air then is being removed by building exhaust systems for areas such as restrooms, kitchens or storage.

It is very common in building investigations that I find the building operating in negative pressure in relationship to the outside environment. The most common causes are poor building pressure design, inadequate HVAC test and balance, addition of building exhaust systems that unbalance the building pressure design, or poor maintenance of existing HVAC systems. These mistakes often lead to fungal contamination, damaged building components, and indoor air quality problems.

In the last decade, building environmental engineers (HVAC engineers) have changed their view of local climatic design conditions. The effects of moisture intrusion into the building forced the design community to rethink the climatic design conditions. It was determined that humidity played a greater role than previously thought. Consequently, current outdoor design conditions now reflect this greater effect of moisture or humidity. You have probably heard the following sometime in the last few years, "It's not the temperature, it's the humidity!" In controlling moisture inside buildings, this is correct. In the humid South, if the engineer does not recognize this, then disaster awaits.

The last area I want to mention is the building plumbing systems. These systems must be designed with building moisture leaks taken in to account. The plumbing systems can cause moisture leaks typically when they penetrate the building envelope. These systems are particularly vulnerable when they enter and exit the building floor slab. Ground source water leaks occur when penetrations are not sealed properly. Of particular concern is the roof drainage system. Who ever thinks that these systems will actually bring water back into the building?

FINAL THOUGHTS

When claims are filed for water leaks or mold and mildew, there might be more to the story. A trained professional has to have more knowledge then just how to clean up the problem. The cause of the problem must be determined and fixed or the water will come back. In addition, there might be latent problems that will continue and cause even worse problems. And there might be a design or installation oversight that is the actual cause of the moisture problem. Moisture management in buildings is a science that demands the attention of the entire building design, construct and maintenance team.

ABOUT THE AUTHOR

Mr. Patenaude is a consulting and forensic engineer specializing in Indoor Air Quality and moisture intrusion into buildings. He is a Distinguished Lecturer and a previous Society Vice President of the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE), a Member of ASHRAE's Task Group TG-I, General Legal Issues, TG-9, Moisture Management in Buildings, a Board member of the Association of Energy Engineers' Certified Indoor Air Quality Professionals, and a member of the National Academy of Forensic Engineers.

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FORCON News

Bill Ver Eecke was given the Board Member of the Year Award by the National Association of Subrogation Professionals at their annual conference in November of 2001. Bill was the chairman of the 2001 NASP conference. He was appointed to serve a second two year term on the NASP Board of Directors and was named the treasurer for the next two years. He continues to serve on the conference committee.

Michael Romansky spoke at the annual Risk and Insurance Management Society (RIMS) meeting in New Orleans in April. His topic was entitled "Evaluating Slip & Fall Claims Using Forensic Biomechanics". Close to a hundred risk managers from around the country attended his hour and a half presentation.

Michael also spoke on this topic at the Florida Insurance Fraud Education Committee, DIF-SIU Conference and the 6th Annual Florida Liability Claims Conference both held in Orlando, Florida in June.

Michael Romansky and **Curt Falany** have been chosen to speak at the 4th Annual National Association of Subrogation Professionals (NASP) Conference on November 11 through 13, 2002 at the Saddlebrook Resort in Tampa, Florida. Michael will address subrogation issues associated with workers compensation claims resulting from construction site injuries. Curt will be part of a team of experts discussing the basic terminology and theories which all subrogation professionals encounter (but may not fully understand) on a daily basis.

Steve Chewning
Forcon's Accident Reconstruction Coordinator
ATLANTA BRAVES ROOKIE???

Ray Patenaude and **Jim Rizk** made presentations as part of a Mold & Mildew seminar given to FCCI Insurance Group in Sarasota. Ray's presentation focused on the effects of moisture on mold and mildew growth in buildings and identifying the source of the moisture. Jim's presentation addressed the different types of fungi, mold and bacteria normally found in building environments, their toxic effects and the different sampling procedures used to identify them.

Walt Laird successfully completed a week long course conducted by the National Association of Fire Investigators and received his certification as a Fire Investigation Instructor (CFII) and as a Fire and Explosion Investigator (CFEI). Walt applies this expertise in the investigation of vehicle fires.

Walt also spoke at the Virginia Association of Defense Attorneys 2002 Spring Section Series on Auto and Premise Liability on May 6 in Richmond, Virginia. His topic was " An Engineer's View of Product Liability". A treatise on building reliable testimony.

Walt is responsible for leading FORCON's Richmond team of engineering consultants.

Walt has two engineering degrees from the Massachusetts Institute of Technology and a degree in Materials Science from the Johns Hopkins University. He is a registered Professional Mechanical Engineer. Walt retired from the Nuclear Power Program of the United States Navy and is a certified naval nuclear engineer. He has taught engineering courses at the U. S. Naval Academy and was a Department of Defense Science and Engineering Fellow at the Johns Hopkins University for three years. Since his active service, he has practiced engineering in the amusement industry and heavy equipment field. He has been conducting forensic investigations since 1995.

His forensic investigation experience includes:

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MOISTURE MANAGEMENT IN BUILDINGS

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