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**MOISTURE MANAGEMENT IN BUILDINGS**

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# **MOISTURE MANAGEMENT IN BUILDINGS**

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## **Introduction**

You are confronted with a complaint from an Obligee, that due to the poor performance of your contractor, the building is leaking and they are looking to you to come in and correct it.

Performance Bond claim investigations typically focus on the workmanship of the Principal, but we suggest there is a need to do more than that because of the potential of an additional claim for “and other damages”.

The following is what is happening due to leaks in the envelope.

"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 than 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 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 cost a great deal of money to remove the water vapor with the air conditioning system. And this energy costs 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.

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. Typical food sources are the cellulose paper on drywall and the paste used for wall coverings.

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

In addition to molds, uncontrolled humidity levels in buildings can be the water source for dust mites. Dust mites typically live in carpets and cloth drapes and fabrics for window treatments. The fecal material from the mites can also cause upper respiratory health problems and trigger asthma in building occupants. Again, there must also be a food source such as dirt brought into the building via the ventilation air source or transported from occupants.

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.

The biggest culprit is the building vapor barrier. As discussed previously, water vapor can move across buildings walls into the occupied space particularly during the humid periods of the year. If the vapor barrier is improperly specified or constructed, then problems will occur. Numerous examples of damage to buildings with poor 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.

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 than is being exhausted by building exhaust systems.

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 elaborate on 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 than 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.

When that Performance Bond claim comes in and there are leaks, the failure of your Principal to do the work in good workmanship like manner may be only a small part of the problem. You may want to have your investigation go one step further and have the other issues contributing to the big problem reviewed.

Closing the envelope in may only reveal that there is a bigger problem and the expense incurred will have been to no avail.

## **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 Board member of the Association of Energy Engineers' Certified Indoor Air Quality Professionals, a Member of ASHRAE's Task Group TG-I, General Legal Issues, TG-MMB, Moisture Management in Buildings, and a member of the National Academy of Forensic Engineers.