EIFS - A SOURCE FOR MOISTURE DAMAGE IN DWELLINGS

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Introduction

Moisture intrusion into the structure and interiors of dwellings has been a consistent and vexatious problem in the multi- and single family communities on the Atlantic Seacoast. Many community associations have seemingly been plagued with repeated instances of moisture damage that has lead to major expenses for their Associations. Moisture damage problems to dwellings are the result of persistent small leaks from the frequent storms on the Atlantic Seacoast and very poor attention to construction quality, defective products and nonexistent details when these dwellings were built. Until fifteen years ago, damage from intruding moisture was small and contained to the area of the leak. With the application of synthetic stucco on residential properties (E.I.F.S. - Exterior Insulation & Finish System) that has changed. EIFS is an exterior wall system developed in Europe and brought to this country in the late '70's. Until the late '80's architects for commercial building projects primarily specified it. Then EIFS manufacturers started heavily promoting their system directly to residential builders and developers as a premium exterior wall system. While the commercial projects had some early problems they were minor compared with the residential projects. Almost immediately the residential projects had major problems with moisture penetration. The same moisture resistant nature of the monolithic EIFS surface that is designed to keep the moisture out of the dwelling, traps the intruding water inside the wall until so much moisture accumulates, that the wood building structure is attacked by mold, rot and termites.

Sources of Moisture

To begin, consider first just how much water is naturally contained in the air of a typical two-storey dwelling with an inside volume of 16,000 cubic feet. If the air in the dwelling were maintained at 30% relative humidity, then the total water content would be 5.75 pounds or approximately 2.6 liters. If the air were completely saturated, that is, 100% RH, it would then contain 8.7 liters of water. Conditions in a dwelling are rarely static, that is, there is almost always some moisture being added to the indoor spaces and some moisture which is lost by ventilation or air leakage [2].

There are many sources that can produce moisture in a dwelling. Among these are humidifiers, people and their activities, basements, crawlspaces, broken pipes, the seasonal storage effect and rain penetration. Each of these is independent of the others, that is, moisture from one source has no link to moisture from another area. Nevertheless, all these sources have a direct influence on the total moisture content of the dwelling and the damage it can cause. High internal moisture content can cause condensation on colder surfaces in the winter months and make the building's air-conditioning system work harder removing that moisture in the summer. However, on the Atlantic Seacoast, unless the dwelling is of unusually tight construction, these internal sources do not produce enough

moisture to create long term damage to the building and its components as happens in more Northern climes.

Rain Penetration

That brings us to the most prevalent problem on the Atlantic Seacoast. Rain penetration is an age-old problem, so you would think developers and builders would have it solved by now. However, it seems as mysterious as ever, since so many community associations still have moisture related building problems. When rainwater appears on the inside, it is generally a sign of a much larger problem. Because most residential walls are constructed without interior cavities flashed to the outside, most rain, which penetrates the cladding drains to the inside. Normally once inside the wall, the moisture vaporizes returning to the outside through the exterior wall materials, cracks, openings and mechanical ventilation. But, with EIFS on the outside and a vapor barrier on the insulation facing toward the inside, the water vapor in the wall has no where to go. Following a long rainfall, moisture may sit in various pockets within the wall, in the insulation and within the wood structure itself. Given its water resistant characteristics, EIFS rarely displays the seriousness of the moisture penetration of the outside of the wall. <See Figure 1>

Depending on the outside temperature, the stack effect can cause moisture on rain-soaked walls to infiltrate the exterior wall, even when there is no wind. The stack effect is especially prevalent in high-rise buildings. Although not strong, it will cause air to infiltrate at the lower portions of the building and in the process, unsaturated cold air will become saturated, thus bringing small but significant amounts of moisture into the building and exacerbating the leak problem.

If we ignore it, will it go away?

The water trapped inside the EIFS wall creates the last component of a very powerful formula for destruction of the wood framing (headers, studs, joists, beams and sheathing) which is the structure that supports the building and keep it from settling, or worse collapsing. Once the exterior wall becomes wet, the warm, dark environment inside is a playground for a happy mix of molds, fungi and termites. The pace of the destruction is very hard to predict, however. Factors such as the size of the leak, frequency of storms, amount of rainfall and permeability of the wall have a big impact on the rate that these organisms destroy the wood. Once the process has started, we have seen many cases where complete destruction of the framing occurs in as little as 5 years after construction was completed. So, the problem doesn't go away. In fact, once the problem makes itself known inside the dwelling, the destruction of the wood wall is well underway. Other materials, such as metal studs, gypsum sheathing and concrete block are adversely affected by water trapped behind EIFS thought the problem may take 10 to 15 years to develop.

The unwelcome guest - toxic mold

Usually the first sign of a problem occurs when the homeowners recognize a dark gray or black mold stain on the wall or carpet. This usually appears first on an exterior wall or on the floor around windows, doorways, balconies and eaves. Many molds naturally grow in

your indoor environment. Mold is a tenacious, unwelcome houseguest. It climbs up bathroom walls, invades carpet and infests drywall. Mold spores may also sneak into your dwelling through open doorways, windows, heating, ventilation, and air conditioning systems. Spores are everywhere in the outdoor environment and attach themselves to you and your pets, making clothing, shoes, bags, and animals convenient agents for carrying mold into your dwelling. When mold spores drop on warm moist places, such as at leaks that have occurred in roofs, walls, bathrooms, plant pots, or where there has been flooding, they will grow. Many building materials in your home provide suitable nutrients that encourage mold to grow. Wet cellulose materials, including paper and paper products, cardboard, carpet backing, wood, and wood products, are particularly conducive for the growth of some molds. Other materials such as dust, paints, wallpaper, insulation materials, drywall, carpet, fabric, and upholstery, commonly support mold growth[1].

According to the Centers for Disease Control and Prevention (CDC) in Atlanta, six varieties of household mold are common, and three can produce toxins. There has been a lot written recently about the health effects of one mold that produces toxic spores. Stachybotrys chartarum (also known by its synonym Stachybotrys atra, and pronounced Stacky-botriss) is a greenish-black mold. The CDC linked it, to 10 cases of lung disorder in infants five years ago and 100 cases since. Unfortunately, it's impossible for homeowners to distinguish between toxic and the benign molds - they all look like black or gray, sooty patches most commonly on walls and floors. It has received so much press lately, because it can grow on material with a high cellulose and low nitrogen content, such as fiberboard, gypsum board, paper, dust, and lint, all of which occur in the walls and interiors of your dwellings. Constant moisture is required for its growth. Determining what type of mold you may have is not necessary, however. All molds should be treated the same with respect to potential health risks and removal.

Are toxic molds something to be alarmed about?

"No," says Carol Johnson, an epidemiologist with the CDC. "You should be concerned, but not panicked. All molds, even the toxic-causing ones, can be cleaned up by the homeowner with a mild bleach solution if they exist in small quantities." In fact, most people never realize that toxic molds are present in their home because they clean them up before they have a chance to grow big enough to present a hazard.

No matter what type of mold is in your home, your safety depends on the size of the infestation. If a leak behind the EIFS causes a black mass more than 2 ft. sq., or if the mold has gotten into the carpet, insulation or drywall, repair the source(s) of incoming moisture and replace these items. If the infestation is a small patch, use a chlorine-bleach solution (1 cup of bleach in 1 gal. of water) and scrub the mold; wear eye protection and a respirator with carbon filters. Never scrape dry mold; that sends potentially toxin-carrying spores flying.

I love my place on the water. What do I do?

So you don't want to move. Keep in mind, the basic problem is the result of persistent small leaks from very poor attention to construction quality, defective products and nonexistent details where the EIFS abuts other materials (windows, doorways, balconies, piping, light fixtures, etc.) when these dwellings were built and the frequent storms on the Atlantic Seacoast. To solve your problem, first define your need. You need to determine the extent of the moisture damage to understand the scope of your problem, by getting a moisture survey performed on the EIFS covered walls and the associated components. It will require punching very small holes through the EIFS to get the moisture probes in contact with the wood beneath the EIFS. This will give you a moisture map of the problem and give you the data needed to make the next decision. Several larger holes need to be made to calibrate the moisture meter results. <See Figure 2> If you want to solve your problems, your next decision concerns how long to you want the fix to last. If you are interested in a short term fix, just remember you are only postponing the inevitable. Most short term fixes are only effective until the next big storm. You will eventually need a long term fix which involves removing the EIFS, replacing the rotten wood and re-building the walls in accordance with specifications prepared by an architect experienced with designs necessary to resist the kinds of damage caused by the storms that regularly lash The Atlantic Seacoast.

Pressure equalized rain screens for medium and high-rise condominiums are another long term solution. Rain penetration control is the objective of the rain screen. If done correctly, rain screens are very effective at stopping wall leaks because they use the wind pressure to equalize the wind force driving water through a wall. The rain screen must be considered as a system and not merely as a vented cladding. The cavity behind the cladding has a very important function in relation to rain screen performance. In response to the problems with EIFS on residential projects, some EIFS manufacturers are claiming to have a rain screen system, but they lack the important pressure equalized features that make them truly effective, so they don't really qualify.

Summary

When all the various sources of moisture are considered, the total moisture input in a dwelling is a combination of that contributed by the occupant, his activities and rain penetration through the building envelope. This can be normally evaporated, but once the moisture is trapped in rain-soaked walls by a water resistant covering such as EIFS, all the wood destroying forces of Mother Nature are quickly mobilized.

References

[1]. Centers for Disease Control,
http://www.cdc.gov/nceh/asthma/factsheets/molds/default.htm

[2]. Richard L. Quirouette, BSI'83 - Moisture Sources in Houses, 1983