Humidity "GETS HIGH" on Medicinal Marijuana

By Dustin T. Smoot, RRC, RRO, LEED AP

Medicinal marijuana is gaining professional acceptance as a treatment for many illnesses such as cancer, AIDS, diabetes, Parkinson's, and more. In 17 states and Washington, DC, there are governmental regulations in place that legalize the use, possession, and distribution of medicinal marijuana.[1] An additional seven states currently have pending legislation to make medicinal marijuana legal.[2] These new statutes have paved the way for an evolving industry of growing marijuana as a legitimate business. Many "grow rooms" are appearing around the country, producing medicine for customers of all classes. These growing facilities vary in size, depending on the number of patients they supply. A legal grow facility can be as small as a residential closet for personal use, or a commercial warehouse supplying product to medicinal clinics and thousands of patients.

Because the business is federally illegal but legal by state law, these grow rooms are often shrouded in secrecy for fear that the federal government will intervene and prosecute. For this reason, the facilities that house these grow rooms are leased in most cases and not designed to be used for this purpose. The leased building is used until the proprietor moves on, at which point the building and any problems that may have developed as a result of the previous occupation are inherited by the property owner. Many of these grow rooms are located in warehouses designed as either unconditioned or semiconditioned spaces. The tenants or growers may not understand the possible damage they could be causing to a building without a properly designed space. They are there for the quick dollar and typically pay a premium rent due to the type of business they conduct.

The nature of growing marijuana involves operating in conditions of high humidity. This atypical environment can wreak havoc on a structure built for other enterprises. Some of the tenants I have come into contact with would not mind spending the money to fix the problem correctly, but they feel that it is too much of a gamble for them to invest such a significant amount due to the fact that their business is still federally illegal, and the government could shut them down at any time. These tenants are looking for a temporary repair that will last them a year or two until their lease is up. In most cases, there is no easy repair. By the time the problem is discovered, it is usually too late, because the damage has been done.

GROW ROOM CONDITIONS

The conditions of these grow rooms are nearly identical to those of an indoor pool. Temperatures between 75° and 85°F (24°C to 30°C) and relative humidity (RH) values between 60% and 65% or higher cause an elevated dew point temperature.[3] This elevated level of humidity comes from the natural transpiration of the plants themselves. When plants are flowering, transpiration—the release of water vapor through their leaves—is at its peak. The high levels of relative humidity can lead to condensation on building components. Most buildings have not been designed to handle the resulting temperature gradient, moisture migration via air movement, and vapor diffusion from interior to exterior space. Elevated temperatures, together with the higher RH, are even more detrimental in cold climates where winter temperatures are cooler for longer periods of time. This causes the vapor drive to be directed from inside to outside, where it can be trapped within the wall/roof, or the wall/roof components can be exposed to this condition for a longer period of time before it can naturally dry out. This makes proper building envelope design very important.

Photo 1 – Very high moisture content. The surface of the wood was wet.

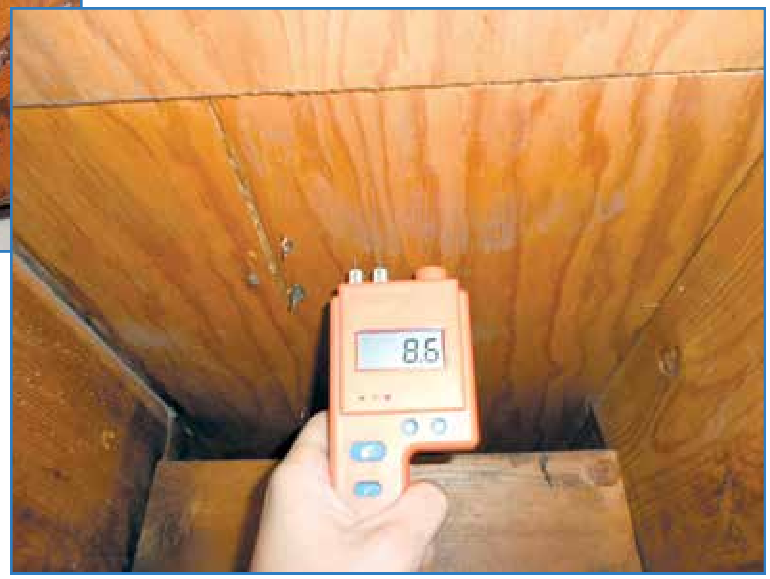

Photo 2 – Adequately ventilated space has moisture content well within acceptable range.

POSSIBLE DAMAGE

Elevated temperature and RH can produce an ideal environment for the propagation of biological growth and an increased likelihood of building material deterioration. This can range from moldy drywall and insulation facer to deteriorated structural components. This can not only cause health issues from poor indoor air quality, but can make the structure susceptible to further damage from the elements.

There are three conditions required for biological growth: moisture, warmth, and organics.[4] All of these conditions were present in the grow room structures that were investigated. This indicates a high likelihood of biological growth development within these buildings, much of which may be hidden from view within a wall or roof system. The interior operating conditions, building design, and materials within the ceiling/wall system dictate the amount of damage that can develop and the rate at which deterioration and biological growth begins. *Photo 1* illustrates a moisture probe reading of 40% moisture content, the highest reading this equipment model can indicate. The glue is migrating out of the plywood, which will cause delamination and loss of strength.

Photo 2 illustrates adjacent joist spaces that were adequately ventilated. These joist spaces had significantly less biological growth and recorded much lower wood moisture content.

With increased moisture also comes an accelerated rate of building material deterioration. Untreated wood should never be subjected to moisture levels over 20%, due to deterioration.[5] Other roof decks of particular concern are Tectum™ or gypsum roof decks. These roof decks were never intended to be subjected to high humidity environments and can easily be weakened by the

Photo 4 – Moisture was accumulating between the roof deck and the BUR.

Photo 3 – Roof deck from below. Note dryness of properly ventilated joist spacing.

absorption of moisture. As for wall systems, the use of wood in walls can deteriorate and propagate biological growth, and masonry wall systems are particularly susceptible to damage when freeze/thaw conditions exist.

CASE STUDY AND INVESTIGATION

A single-story, approximately 6,000-sq.-ft. masonry and wood construction warehouse was reported to have roof leaks.

The originator of the call was a roofing contractor. The building tenant indicated the roof was leaking. The roofing contractor had checked for leaks and believed that condensation was causing the observed moisture. In the structure's three adjacent grow rooms, the middle room ceiling had been demolished, and the roof deck and joists were visible.

The insulation was saturated and had been removed. The roof covering was a polyvinyl chloride (PVC) single-ply membrane roof installed over ½-in. extruded polystyrene (EXPS). The roof system was mechanically attached over an existing built-up roof (BUR) directly over a plywood roof deck. The original roof insulation was fiberglass batts located below the roof deck. Snow had been cleared off of the roof by the roofing contractor in order to perform intrusive testing. The underside of the roof decking was observed (*Photo 3*). Multiple roof samples were taken above the observable area. Additional samples were taken in a few specific locations, in particularly dry and particularly wet areas, to verify conditions above certain areas. The following observations were made, which indicated the observed moisture and resulting damage were caused by internal moisture load accumulations:

- The roof cuts showed the moisture was present below the original BUR only (*Photo 4*). None of the cuts had evidence of moisture between the BUR and the PVC membrane. This indicates the moisture had traveled up through the interior of the structure and condensed on the bottom side of the material, which had a permeance low enough to retard the flow of moisture—in this case, the BUR. Because there was little insulation above the BUR, the temperature of its surface fell below the dew point, which allowed condensation to form.
- The underside of the roof deck had evidence of moisture on nearly all of the surfaces of the plywood. The moisture content of the wood was elevated in all but a few of the areas. The locations that did not show evidence of moisture deterioration were between specific joist spaces that had been vented to the outside.
- The "leaks" were observed predominantly after cold spells of weather, usually coinciding with the flowering stage of the plants. This is the time when the plant is largest and at its highest rate of transpiration; therefore, the room is at its highest RH. This high RH, in combination with a large temperature gradient from interior to exterior, forms an unfavorable condition if it does not include a properly designed building envelope and mechanical ventilation system.
- The walls were of a concrete masonry unit (CMU) block, which was painted multiple times on the outside only. Paint can act as a vapor retarder when applied in sufficient thickness. Although no damage was observed on the exterior of the building, it is likely the moisture content near the outside of that block was elevated.

POSSIBLE SOLUTIONS

If the owner has been educated about best practices for operating these grow rooms, he or she can require the tenant to build out the space to minimize the possibility of long-term structural damage. Several plans can be implemented to reduce humidity and its effect on the structure:

- Hire a qualified building envelope consultant. This consultant should have experience with temperature gradients as well as hygrothermal analysis and design of structures such as indoor pools and/or refrigeration buildings.
- Install a properly insulated building envelope with a vapor retarder or barrier on the "warm-in-winter" side of the insulation. Hygrothermal calculations should be performed on the proposed system to assure the dew point does not occur at the vapor retarder.[5]
- Incorporate a primary plane of airtightness in the design/construction so as to significantly limit the amount of moisture-laden air transport.
- Properly ventilate the space between the grow room wall and the exterior wall. This could be done by creating a "building" inside a building, making the exterior of the grow room the semiconditioned space of the warehouse rather than the harsh environment of the actual exterior of the building.
- Install a properly designed mechanical system to effectively ventilate and/or dehumidify the air within the grow area and minimize the humidity.

CONCLUSION

Proper building maintenance practices should be implemented by owners who choose to lease their buildings to grow facilities. This will ensure that long-term damage to their buildings is avoided. Basic methods for investigating and designing these grow facilities have been touched upon here, but it is not the intent of this article to completely educate the reader on growing facility building design but rather to bring their complexities to light. Each and every building type, design, use, and occupancy is different, so there is, unfortunately, not a one-size-fits-all recommendation for the retrofit design of a space to successfully maintain a growing-room operation. It is the responsibility of the consultant to educate his or her clients (e.g., property managers and building owners) about the possible conditions that can be produced under growing-room occupancy, as well as the short- and long-term effects that it could have on the structure of the building. With proper design, these grow rooms can easily be retrofitted into most buildings, making for a good tenant, a healthy building, and properly medicated people.

REFERENCES

1. Mary Ellen Clark, "Medical Marijuana Legalized in Connecticut," NBCNEWS.com, June 1, 2012, http://www.msnbc.msn.com/id/47651807/ns/health-health_care/#.T8lk6O3K2Ig. States that have enacted laws to legalize medical marijuana include Alaska, Arizona, California, Colorado, Connecticut, Delaware, Hawaii, Maine, Michigan, Montana, Nevada, New Jersey, New Mexico, Oregon, Rhode Island, Vermont, and Washington, as well as Washington, DC.
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4. Craig DeWitt, PhD, PE, "Wood Moi-sture Content," Jan. 3, 2002, www.rlcengineering.com/wmc.htm.
5. John Straube and Eric Burnett, "Overview of Hygrothermal Analysis Methods (HAM)," *Moisture Analysis and Condensation Control in Building Envelopes*, Chapter 5, ASTM MNL40, 2001, Philadelphia, PA, edited by Heinz R. Trechsel.

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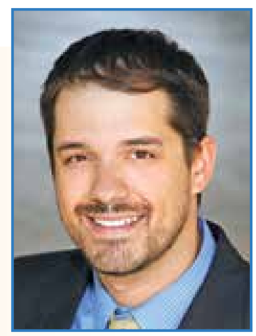

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