MOLD SHOULD NOT BE IGNORED

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IT DOESN'T TAKE MORE than a cursory glance at news headlines to bring home the fact that mold (fungus) has become an issue of public concern. Headlines such as "Deadly Mold Discovered in Metro Homes" and "Toxic Mold Closes Schools" have raised public awareness as well as generated panic. Skeptics have responded by pointing out that mold has been around since the origin of mankind and that the dangers of mold are overstated by enterprising remediation contractors and mold lawyers.

The causal relationship between mold and reported health effects, ranging from asthma to serious brain disorders, has been challenged in recent court cases. In the now famous Texas case, *Ballard vs. Farmers Insurance*, the judge disallowed expert medical testimony on the basis that epidemiological evidence is not yet available. However, the jury awarded $32 million for mold damage to the home and associated mental anguish.

In the midst of the dispute over dangers associated with mold, a 1999 study from the Mayo Clinic concluded that mold causes most sinus infections and a report from the Institute of Medicine listed mold as an asthma trigger. To address inconsistencies regarding mold, the American Conference of Governmental Industrial Hygienists (ACGIH®) in 1999 published *Bioaerosols: Assessment and Control*, which has become a standard for evaluating biological contamination in indoor environments.

The consensus among indoor air quality experts is that mold and bacteria in indoor environments are potentially dangerous and should be controlled. The health effects associated with mold can include allergies, infections and toxicosis. Allergic reactions to mold are by far the most common health effects. Molds are foreign substances to which our bodies will develop antibodies. The more mold we breathe, the more antibodies we produce.

When enough antibodies are produced, exposure to the same mold will result in a histamine reaction which can vary from a runny nose and headache to skin rashes and asthma attacks. Molds that can grow at elevated temperatures can cause infections in humans. Individuals susceptible to fungal infections are diabetics, burn victims, AIDS patients, organ transplant recipients, very young or elderly people, and individuals taking immunosuppressive drugs.

CONTRIBUTING FACTORS

When asked, "Why is mold such an issue now — hasn't it always been around?" my first instinct is to point out that science and medicine are not stagnant and new discoveries are made every day. Remember, a few decades ago we only suspected cigarettes caused cancer. Unfortunately, we now have the epidemiological knowledge to prove the theory.

Yet, if put to the task of identifying the number one contributing factor to the mold issue, I would point to current building practices. First, an ex-

planation on how mold grows is necessary. The requirements for mold growth indoors are a source of mold spores, nutrient material, appropriate temperature and moisture. Mold spores are ubiquitous in nature. They enter homes from windows and doors, and are probably present in the lumber. All cellulose-containing building materials are good food sources for mold, and ambient temperatures suit mold just fine. Therefore, the controlling factor in mold growth is moisture. The type of mold that will colonize and grow on indoor building materials is dependent upon the food source and the amount of moisture present.

A primary invading mold, such as *Aspergillus versicolor*, will grow on wood, wallpaper, or fiberboards, and requires moderate moisture. Whereas, more selective molds such as *Stachybotrys* prefer the low nitrogen content of drywall and ceiling tiles. Additionally, *Stachybotrys* and other hydrophilic (water-loving) molds need lots of moisture to grow.

Common mistakes in the home construction industry allow for water infiltration into the building envelope, with little to no means for the water to exit. No building can be constructed to be waterproof, but they can be built to be more forgiving. A common problem observed in mold-infested homes is improper flashing that allow water to enter exterior wall cavities at windows, chimneys, and doors. The absence of weep holes and cavities blocked by mortar prevent moisture from exiting the building. Once water is trapped in the wall cavities, dormant mold spores come alive for a feeding frenzy on the exterior sheathing. With enough moisture, water will eventually wick into interior walls and colonize on drywall, insulation, and studs.

The selection of drywall as opposed to plaster for interior walls is another reason mold contamination is more prominent today. Drywall is porous and will soak up and maintain water long enough for mold to grow. Unless a water intrusion is repeated, plaster will often dry before significant colonization can occur.

Another common construction defect that results in a mold

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CASE 1

Condominium on second floor. Water chronically leaked into furnace room causing Stachybotrys growth on drywall. The first signs the homeowner observed were large mushrooms on a carpet after a bed was moved (Photo 1). The bedroom was directly behind the furnace room.

Photo 1. Large mushrooms on carpet. Furnace room is behind the return grille on the wall. Black on wall is Stachybotrys.

Photo 2. Ceiling of furnace room. Black is Stachybotrys.

Photo 3. Furnace room.

Photo 4. Close-up photo of Stachybotrys on the wall in Photo 3.

friendly environment is inadequate ventilation in attics and crawlspaces. Lack of ventilation on roofs and in crawlspaces can result in moisture condensation on wood surfaces. Highly porous plywood and OSB decking are especially prone to mold growth. Water infiltration due to ice damming, caused by melting and re-freezing of snow at eave troughs, is another consequence of poor roof ventilation.

Water infiltration into basement walls is significant in many buildings. Ground-water intrusion into basement walls accounts for more than 30 percent of my mold-related investigations. In homes with finished basement walls, intermittent water infiltration often goes undetected for years. Fiberglass insulation installed against foundation walls will soak up moisture and wet the backside of drywall with subsequent mold growth frequently covering 75 to 100 percent of the backside of the drywall, often before any visible damage is apparent.

Still another reason mold is a bigger issue today is that indoor exposures are more significant due to tight building construction. New ventilation practices that focus on energy conservation allow contaminants to become concentrated indoors. Five decades ago, an average home would have five to six air changes an hour due to random holes at doors, windows and walls. Today, homes can legally be constructed with as little as .35 air changes per hour. In other words, we are living in conditions similar to a zip lock bag where contaminants have no way to escape.

THE ROLE OF WATER

The construction industry is not the only entity that has nourished recent concerns over mold. Far too often, mold growth could have been avoided after water disaster events if drying technologies had been immediately implemented. To prevent mold growth, porous water-damaged materials must be dried within 48 hours. However, if improperly dried, the microbial content of a porous material that sustains moisture for one week is equivalent to raw sewage. Unfortunately, debates over insurance coverage and causation often take precedence over mitigating water-related losses.

Obviously, water can be the most damaging factor that a building and its occupants experience. Water can deteriorate building materials and support microbial growth. Improperly mitigated water damage can contaminate buildings long after surfaces have dried. Nature provides mold spores with defense mechanisms to make sure species survive. When moisture is removed from actively growing mold, "fear of dying" causes the mold to produce millions of spores. The invisible spores can become airborne and subsequently settle onto building materials until new moisture for re-growth is supplied. Indoor exposure hazards associated with mold are often greatest when surfaces are first dried. The human body can react equally to mold spores whether dead or alive.

Recognizing the importance of water damage, mold growth and potential health hazards, various governmental agencies and scientific organizations have published guidelines for preventing, identifying and remediating mold in indoor environments. "Mold Remediation in Schools and Commercial Buildings," published in March 2001 and "Assessment and Remediation of Fungi in

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Indoor Environments," published by the New York City Department of Health in April 2000, have become the de facto consensus documents in the indoor air quality industry. These documents establish protocol for removing mold-contaminated building materials without causing cross contamination that could increase exposure risks. Both documents designate levels of remedial containment methodologies based on the extent of visible growth in a building. For example, mold growth on a ceiling tile would require minimal personal protection and no containment barriers. Whereas, visible growth covering more than 100 square feet of drywall would require sophisticated abatement technologies similar to those used for asbestos removal.

While recent remediation standards have done a great deal to improve credibility in the mold industry, they have raised some additional concerns. For example, establishing criteria for protecting a building during disturbances to moldy surfaces is important, but limiting containment measures for minimal visible growth can be confusing and dangerous. The EPA document acknowledges that mold growth is often hidden in wall cavities. However, significant exposure hazards and cross contamination could occur if a wall displaying minimal growth on the facing and extensive growth on the backside were to be ripped out without proper containment.

MOLD INSPECTION PLAN

Obviously we've learned a lot about mold in the past 10 years; with the general consensus being indoor mold growth is undesirable and should be avoided. The ultimate goal of building officials, inspectors, homeowners, and insurance providers should be prevention. Prevention through proactive design strategies and quality construction should be a top priority for code officials. For existing buildings, inspectors should be trained to identify potential mold and moisture problems in buildings. Additionally, homebuyer awareness programs and current legislative initiatives to enforce seller disclosures are also positive steps.

Mitigation of existing mold problems before health hazards arise is important. Fortunately, detection of mold does not require a microbiology degree or expensive equipment. A trained inspector can usually identify mold contamination without testing. Elements of a good mold inspection should include:

- Visual observations into probable moisture problem locations such as ceilings under bathrooms and kitchens, crawlspaces, roof decks, plumbing chases, perimeter walls behind furniture and finished basement walls;
- Evaluation of exterior grade, drainage systems, gutters and downspouts to

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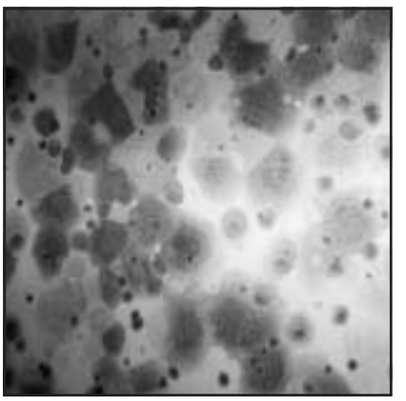
Case 2

A water pipe burst while homeowner was on vacation. Neighbor discovered leak after two weeks. Two months later, carpeting and walls still saturated. No emergency drying performed. Water wicked up 4 feet on drywall, causing significant mold.

Above, Penicillium, Aspergillus and Stachybotrys on closet wall.

Above, Water wicked up bathroom wall causing growth.



Above, Close-up photo of mold.

ensure water is diverted away from foundation walls;
- Surface moisture measurements in suspect areas such as basement walls, roof decks, bathroom walls and ceilings under plumbing; and
- Exterior inspections to evaluate flashing, cracks, stains, weep holes, and vents.

Testing for mold contamination can be indicated in certain circumstances. A physician might request mold testing to assist in diagnosing an illness. Documentation of air quality is frequently requested to support litigation or to identify contaminant levels before and after remediation. Selection of an air testing professional is paramount to obtaining good information. Some testing methodologies are prone to false negative results and often do more harm than good. Factors to be considered in selecting an air testing company should include:

- Trained professional with a science degree and experience;
- Collection of both culturable and spore trap air samples;
- Calibrated equipment that is recognized in the industry (Andersen sampling device is one of the most popular);
- Collection of source samples to include wipe or bulk;
- Documentation of temperature and relative humidity;
- Quality control to include sterile techniques, field blanks, and sample documentation;
- Sufficient number of samples to document normal activities in affected and nonaffected areas as well as outdoor reference; and
- Analysis by a qualified environmental laboratory (minimum requirements should be participation in the American Industrial Hygiene Association Environmental Microbiology Proficiency Testing Assessment Program—EMPAT).

CASE 3

Water leak from window (caused by inadequate flashing) caused significant growth on backside of drywall before visible signs were apparent. The subfloor under the carpet was also affected without signs showing on the carpet.

The debates over mold—whether it causes specific illnesses, how it should properly be removed, and who should pay for the removal—are not likely to be settled in the near future. We do know that water damage causes mold and mold can make people sick. These two factors ensure that mold-related issues are not going away. Proposed changes in the insurance industry might shift the focus on payment to homebuilders, municipalities, home inspectors, landlords and homeowners. Fear of litigation and public awareness will likely be the driving factors that force improvements to the construction industry and building management sector.