THE GROWING PROBLEM OF MOLD

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Media attention and the public's perception or fear of "toxic mold exposure" hit a peak in 2001 when a Texas couple was awarded $32 million in a lawsuit {(*Ballard v. Farmers Insurance Exchange*, No. 99-05252 (Travis Co., Texas, Dist. Ct)]. A December 19, 2002 Appeals Court verdict disallowed $17 million for mental anguish and punitive damages; however, the Court still awarded $4 million plus interest as well as lawyers' fees. An appeal is expected.

Mold is prominent in the news. But why now? This article summarizes some salient issues involving mold, including: (a) the current status of mold "science" and regulations; (b) what causes mold within indoor environments; (c) how the presence of mold is evaluated, and its implications for exposure; and (d) basic considerations in mold remediation projects.

Mold: Why Now?

Actually, "mold" is a general, conversational term for visible fungal growth. It is roughly equivalent to a gardener's use of the term "weed" for a plant growing where it is unwanted. The term "fungi" includes molds, bacteria, and viruses. Molds are the largest component of the fungal classification, so the two terms are often used interchangeably and indiscriminately. The earliest reference to mold contamination and remediation can be found in the Old Testament (Leviticus 14:33-47]). Mold is ubiquitous in the environment, and is commonly due to construction defects that cause water intrusion in buildings. Fueling media attention and the public's concerns is the relatively poor understanding of health effects by general medical practitioners, and the lack of comprehensive regulations or standards concerning allowable exposure criteria for the numerous, known genera of fungi that are known. Add this factor to the various known species of fungi, and the research that needs to be done is staggering.

The Basics

The very *presence* of mold spores is normal in the environment. However, the presence of mold *growth* indoors is not normal and may pose health and/or comfort risks to some exposed occupants. Mold growth requires spores ("seeds"), favorable temperatures, a food supply, and moisture. Like plants, mold grows by spreading, and the release of spores. Mold easily spreads outward under favorable conditions. However, if conditions are unfavorable for growth, mold will go dormant and release spores into the air so they can find a suitable environment for survival.

Moisture, nutrients, and favorable temperatures can lead to mold growth in water-damaged materials in 24 to 48 hours. Affected materials should be dried promptly to prevent germination and subsequent mold growth. Relative humidity levels less than 30% yield little growth. Humidity levels greater than 70% yield optimal growth. Nutrients include dust, dirt, soiled surfaces, and organic building materials (e.g., wood, latex paint, drywall, and carpet). Ideal temperatures for mold growth range from 40° F to 100° F. Since this range encompasses comfort temperatures for occupied spaces with ordinary nutrients already available, it is no wonder that mold has many opportunities to propagate. This growth can result from inadequate design, installation, operation, and/or maintenance of the site, building envelope, HVAC system, and/or building. In fact, we can only really control moisture.

Status Of "Mold Science" And Regulations

Unlike workplace exposure levels for physical and chemical agents, no regulations, comprehensive standards, or guidelines currently exist for determining safe levels of mold. There is a lack of information on specific human responses to mold contaminants. Current exposure assessments are based on the judgment of an experienced industrial hygienist, or other qualified indoor air quality professional, using indoor and outdoor comparisons of fungal counts and types.

This may change shortly as a number of possible organizations emerge to shape the science of mold. They include the Centers for Disease Control (CDC), the U.S. Environmental Protection Agency (EPA), the National Institute for Occupational Safety and Health (NIOSH), guidelines such as the "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" published in April 2000 by the New York

City Department Of Health, the Equal Employment Opportunity Commission/Americans with Disabilities Act, and the American Industrial Hygiene Association's (AIHA) May, 2001 "Report by the Microbial Growth Task Force."

The lack of well accepted regulations, standards, and guidelines is the largest reason why mold litigation has faltered. Daubert/Frye challenges have been successfully used to prevent fungal testing and medical testimony from being admitted into many court cases (the Ballard case was ultimately based on insurance bad faith issues).

However, recent developments may change the information and facts that we use. The US Toxic Mold Safety & Protection Act of 2002 (HR 5040), a/k/a the "Melina Bill", was sponsored by J. Conyers, Jr., (D-Mich.). The bill was introduced into Congress on June 27, 2002, and addresses mold in residential homes and government buildings. The full text is available at http://www.house.gov/conyers/Mold_Bill.pdf. The bill's basic provisions include (a) establishing guidelines and defining acceptable mold levels; (b) establishing minimum training levels and requirements for the licensing of environmental inspectors and environmental laboratories; (c) providing funds to the CDC and NIH to conduct extensive research and testing to determine the range and magnitude of the black mold infestation problems; (d) providing a 50% tax credit to home owners who pay for a mold inspection, and the creation of a national database of homes found to be infested with toxic mold; (e) requiring the EPA to establish construction standards and techniques; (f) establishing mold remediation criteria; and (g) establishing a national toxic mold insurance program to protect homeowners who are victimized by toxic mold.

Various states have introduced regulatory initiatives regarding mold or indoor air quality in general. With the exception of California's Senate Bill 732, which became effective in January 2002, these initiatives have largely stalled.

Also lacking are comprehensive standards for mold testing. In April 2002, the "Standards of Practice for the Assessment of Indoor Environmental Quality" was published by the Indoor Environmental Standards Organization (IESO). The first five standards in this document reflect commonly accepted guidelines for sampling mold on surfaces, in air, and within carpets. The last two sections, however, contain new criteria for evaluating mold colonization on surfaces, and for inspecting residential structures for mold contamination. These documents are the first of what may become a family of standards for mold investigations. ASTM International has recently announced plans to develop a "Standard Practice for Transactional Screening of Readily Observable Mold in Commercial Buildings" through its E50 Committee. The goal is to define standards of care that will: (a) establish the indicated industry standard practice; (b) improve the quality and consistency of mold screening reports; and (c) ensure that the practice of mold screening is appropriate, reasonable, and reflective of good industry practice. The E50 Committee is just forming. Their first meeting is scheduled for April, 2003, so it is unlikely that a new standard will emerge soon.

A standard exists for mold remediation. Published by the Institute of Inspection Cleaning and Restoration Certification (IICRC), their "IICRC S500, Standard and Reference Guide for Professional Water Damage Restoration, 2nd Edition (1999)" serves as the written body of knowledge in the water damage restoration industry.

Causes of Interior Mold Growth

Building defects leading to moisture intrusion include non-continuous vapor retarder installation; substandard flashing, roofing, waterproofing, or window installation; poor wall waterproofing; storage and handling of construction materials that contributes to their exposure to rain; the presence of construction debris; and the formation of ice dams. These defects cause moisture inside the structure which then contributes to mold growth.

A number of potentially responsible parties may be involved in building defect claims involving mold. For example, construction managers, project architects, mechanical engineers, and subcontractors may be responsible for improper design or maintenance of buildings and heating, ventilation, and air-conditioning systems; specifying improper materials or methods; and poor workmanship. Product manufacturers may be responsible for the design and operation of equipment or building materials. Landlords, and property management companies may be responsible for failing to properly maintain the building or its systems, allowing tenant actions that lead to mold growth, or failing to disclose facts relating to water events that caused mold growth. Tenants that fail to maintain their HVAC systems properly, or engage in activities that foster mold growth are also potential parties. Water extraction ("remediation") companies may not completely remove all moisture or mold, resulting in additional growth and contamination. Property inspection companies may fail to discover mold propagating conditions.

What Are The Potential Health Effects From Mold Exposure?
Health effects of fungal exposure are reported to include sensitization, infection, irritating effects (rashes, etc.), Organic Dust Toxic Syndrome (ODTS). Other reported toxic health effects include headaches, respiratory ailments, inhibition of the immune system, lung disease, cognitive memory loss, and brain damage. The lack of dose-response data, as well as time variability of exposure, makes it difficult to establish exposure limits such as those that currently exist for workplace chemicals. However, the Mayo Clinic and others have published studies associating dampness with cough, wheeze, asthma, and respiratory infection. Exposure may be due to spores, or the mycotoxins that fungi emit. Mold's characteristic "musty odor" is due to these microbial volatile organic compounds (mVOCs) released by fungi.

Why Test?
How should one approach a mold situation to determine its impact on the health of these exposed occupants? If mold is visible, some investigators suggest that sampling is not necessary, and remediation should begin as soon as possible to correct health, structural, or aesthetic concerns. Testing during fungal investigations may be expensive. However, *not* performing environmental sampling leaves unanswered questions of what types (genera and species) and levels of mold were present. This information may be especially important if adverse health effects to occupants are known or suspected.

Therefore, a simple visual inspection should not be equated with a competent investigation. Mold sampling attempts to characterize typical and worst-case exposure assessments to develop a building baseline. Sampling may also be useful to maintain acceptable levels while a remediation project is on hold, or to challenge the effectiveness of a remediation project.

At best, sampling involves acquiring random grab samples. Practical considerations for environmental sampling involve: (a) making sure that the sampling actions are repeatable; (b) the availability of time, people, and appropriate sampling equipment; (c) whether the investigation should test for viable or nonviable organisms and, if viable organisms are important, whether data at the genus or species level is important; and (d) expenses.

Using an accredited laboratory services is key. Over 120 laboratories participate in the AIHA's Environmental Microbiology Proficiency Analytical Testing Program (EMPAT). However, currently only 14 laboratories (12 in the US and two in Canada) have successfully achieved accreditation under the AIHA's Environmental Microbiology Laboratory Accreditation Program (EMLAP). A list of EMLAP laboratories is available at http://www.aiha.org/LaboratoryServices/html/emlap.htm.

A basic sampling protocol generally involves at least one air sampling location outdoors, indoors in an anticipated high exposure ("complaint") area, and indoors in an anticipated low exposure ("non-complaint") area. Air samples may be complemented by surface samples, carpet dust samples, and wall cavity samples (as appropriate) to adequately characterize mold presence. Surface sampling is a non-destructive technique that allows for the determination of possible surface contamination on walls, and content items such as furniture. Carpet dust samples help determine if poor carpet maintenance and water incursions provide organisms with moisture and a nutritional substrate to proliferate to problematic levels. Wall cavity sampling is a minimally intrusive method for determining if mold growth has occurred within walls, even though mold may not be visible.

Interpreting the Test Data
The generally accepted guidelines for interpreting mold sampling data are: (a) indoor levels should not be significantly greater than outdoor levels; (b) non-complaint areas should be less than complaint areas; and (c) in complaint areas, mold types should be consistently present. Relative levels and their relative orders of magnitude are also important. The analysis should consider the rank order assessment of mold found (e.g., those with health effects versus those that are relatively common and benign), and the presence of dominant species. Data interpretation should be performed by an industrial hygienist or other qualified indoor air quality professional.

Mold Remediation
Mold spores can be easily dispersed. Correcting significant mold conditions, which is not a job for the home handyman. Renovation is not equivalent to remediation. In addition to the standards for water restoration and remediation, some guidelines exist for mold remediation. Examples include the previously mentioned NYC DOH “Guidelines” and “Fungal Contamination in Public Buildings: a Guide to Recognition and Management” published by the Federal-Provincial Committee on Environmental and Occupational Health, Environmental Health Directorate, Health Canada (June 1995). However, their guidance is not without controversy.

Mold remediation should only be attempted after the conditions that caused mold growth have been identified and corrected. Porous materials that show extensive mold growth should then be removed. Nonporous materials should have their surfaces cleaned to typical background levels. Moisture levels should be reduced to and maintained at levels that do not promote mold growth. The amount of contamination governs the level of containment (use of critical barriers), work practices (HEPA vacuuming, negative pressurization, wet methods), and personal protective equipment (respirators, full-body covering) necessary to prevent the release of mold spores into unaffected areas and protect human health. Mold contaminated materials are not considered as hazardous waste.

Post-remediation validation (a/k/a “clearance”) testing should be performed after remediation activities have ceased, but before critical barriers have been removed. The first step in testing is a visual inspection to ensure that no visible dust or fungal growth exists. If it does not meet this and other qualitative criteria, the job “fails” and recleaning is required. Only if all visible mold and dust ahs been removed should environmental sampling be performed. Typically, more extensive testing is done than in pre-remediation mold testing to ensure that building occupants will have a healthy environment in which to live.

Summary
Molds are complex and can form large colonies indoors under appropriate conditions. Human exposure data causally linking health effects to molds is currently unavailable. Is the fear of “toxic mold” being overblown? Only additional scientific studies will answer that question. But one must not ignore the significance of properly managed building environments to prevent the aesthetic, structural, and potential health effects of mold growth, and the need to promptly and properly evaluate and remediate conditions where mold growth is suspected or known.

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