Air Quality Issues in Commercial Buildings

Although regulations abound governing handling of asbestos and lead-based paint during renovation and construction, there are no federal standards for mold testing and no state laws or regulations regarding mold. A number of state and federal agencies, along with professional environmental consulting firms, make recommendations regarding mold cleanup. The following bulletin from ATC Associates, Inc. discusses mold assessment techniques in commercial buildings.

Across the United States, property managers, building owners, banks and insurance companies are being confronted with what is becoming a multibillion-dollar problem: mold. Approximately 9,000 lawsuits claiming property damage, personal injury and related losses due to toxic mold have been filed in the United States and Canada during the past 10 years, according to National Underwriter Property & Casualty—Risk & Benefits Management. In 2001, mold cost insurance underwriters more than $1.3 billion, based on an estimate from The Environmental Education Foundation in St. Paul, Minn. The Foundation estimated that awards for such claims are running between $200,000 and $400,000.

Many of the largest settlements and jury awards have involved commercial buildings. The discovery of [what has been called “toxic”] mold in the workplace has forced employers to seal offices or relocate workers, and has spawned a wave of personal injury claims.
against building contractors, architects, owners and property managers. In San Martin, Calif., for example, the Santa Clara County Courthouse was temporarily closed due to mold, forcing employees into trailers for temporary offices. A lawsuit alleging building deficiencies against the building’s general contractor, architect and others ended up being settled for $12 million, reported USA Today. In Stuart, Fla., the Martin County Courthouse was closed and completely gutted after mold was discovered. The county sued the construction manager and was awarded a $14 million jury award to cover cleanup and other costs. In Bartow, Fla., the Polk County Courthouse was forced to spend $30 million to correct problems that lead to microbial infestation.

CAUSE AND EFFECT

Mold and mildew can be found anywhere that a moisture problem exists. It grows on any organic substance including wood, paper, carpet, foods and insulation. According to the Environmental Protection Agency, some problems have been linked to building construction practices during the past 30 years, which have resulted in more tightly sealed buildings that might not allow moisture to escape. Reduced ventilation rates to save energy is another contributing factor. Although most indoor air contaminants do not have a serious impact on the healthy work force, problems can occur when fungi such as Stachybotrys and Aspergillus become concentrated, producing airborne allergenic spores and mycotoxins. These irritants can affect the respiratory system, resulting in symptoms such as watery eyes, runny nose and sneezing, nasal congestion, itching, coughing, wheezing and difficulty breathing, headache and fatigue. Severe exposure can result in pneumonia, central nervous system damage, and even cancer, according to an article in Occupational Health & Safety.

In one office location in Sacramento, Calif., a broken water pipe resulted in an infestation of toxic molds at 2,200 times the levels found outside the building, according to Occupational Health & Safety. Workers at that business developed spontaneous nosebleeds and respiratory infections. The business was forced to relocate, and the building’s property manager was sued.

In an office tower in New Orleans, hundreds of office workers became ill when water damage caused a mold infestation. Employees experienced rashes, runny noses and breathing problems so severe that some had to bring oxygen to meetings, according to USA Today Employees filed a class-action lawsuit against the building’s owner and the state of New Orleans.

WHAT TO DO

Unlike asbestos or lead-based paint, there are few regulations governing indoor air quality contaminants. There are no current state or federal regulations dictating the requirements of mold investigations. This lack of standardized, circumscribed requirements and protocols allow for variability in the way microbial assessments are performed on any given project. Typically, an initial investigation of the affected site is conducted to determine the presence and extent of fungal colonization of building materials due to water damage.

When inspecting buildings for signs of mold growth, moisture, leaks or spills, the EPA recommends checking for musty odors, water stains or discoloration on the ceiling, walls, floors and windowsills. Inspectors also should check in restrooms, around and under sinks for standing water, water stains or mold. Other telltale signs of mold include leaky windows, condensation on sills, paint and wallpaper delamination, stained carpeting, presence of multiple portable humidifiers and standing water in air conditioning or refrigerator drip pans.

Under some conditions, mold may grow on hidden surfaces, such as the backside of drywall, wallpaper or paneling, on top of ceiling tiles, or on the underside of carpets and pads. Vinyl wallpaper covering drywall may act as a vapor barrier, trapping moisture underneath its surface, creating a moist environment for mold to grow in. Other locations can include pipe chases and utility tunnels with leaking or condensing pipes, walls behind book-
Moisture mapping of a water-damaged area can delineate areas that require drying and potentially delineate mold-contaminated areas.

shelves and casework where condensation forms, and inside ductwork. Under these conditions, the EPA recommends seeking a professional with experience in conducting mold assessments.

FIELD ASSESSMENTS

Recommended protocols for the collection of environmental samples have been published in the American Industrial Hygiene Association Field Guide (1996), the American Conference of Governmental Industrial Hygienists Bioaerosols: Assessment and Control (Macher, 1999), and the National Institute for Occupational Safety and Health Manual of Analytical Methods, (1994, with update supplements).

Typically, collection of environmental samples may not be necessary when fungal contamination is readily observable. Odors considered to be related to the release of volatile organic compounds by molds may trigger a need for sampling to determine if reservoirs of hidden mold exist.

The EPA recommends that sampling for mold be conducted by professionals with specific experience in designing mold sampling protocols, sampling methods and interpretation of results. Type of samples listed by the EPA include air samples that can be analyzed by direct microscopic examination for total spore counts (called a spore trap method), surface samples, bulk samples (chunks of carpet, insulation, wallboard, etc.), and water samples from condensate drain pans or cooling towers. Use of moisture meters also can determine the presence, location and extent of water damaged building materials. Moisture mapping of a water-damaged area can delineate areas that require drying and potentially delineate mold-contaminated areas.

Hidden mold generally is inspected by destructive methods that include removing a portion of the wall and performing a visual inspection, or collecting bioaerosol samples through a small hole drilled in the wall. Another method uses a boroscope, which is a specially designed flexible, fiber-optic probe with a light source to perform a visual inspection by being inserted into a wall system through a drilled hole.

PROACTIVE PLANNING

Architects, contractors, insurance companies and building managers are looking for a safe and financially viable solution to the problems of water intrusion and the resulting microbial growth. Proactive planning is necessary to make buildings less susceptible to moisture problems during the design and construction phases and to respond to unavoidable moisture problems that may occur. Some insurance companies and owners now require Operations & Maintenance Plans for moisture control and water damage response.

Time is the critical element in responding to water intrusion and moisture issues. What begins as an inexpensive drying process if responded to within 24 hours, if left unattended, can develop into a mold contamination problem that has health implications, disrupts business and requires expensive remediation. Key elements to an O&M plan for microbial and moisture management include the following:

- Establishing and explaining objectives, both short term (stop the water and dry the damage) and long term (prevent the water intrusion).
- Identifying responsible individuals, including project leadership, appropriate consultants and response/drying remediation contractors, architects and construction contractors.
- Creating response plans for various water intrusion scenarios.
- Scheduling regular maintenance and defining inspection requirements.
- Developing supply checklists for HVAC, building envelope and grounds inspection.

During construction and renovation, the O&M plan provides guidelines to prevent water intrusion, including the following:

- Timing of building envelope completion. (In one recent case, lack of sealed windows permitted gypsum board and insulation to become wet.)
- Reviewing site drainage and completion issues. (On one recent project, storm drains were covered, which caused a flood that damaged nearby finished rooms.)
- Maintaining dry storage areas for sen-
Once water damage has occurred, it is important to find the cause of moisture infiltration and fix it, then remove and restore the affected building materials. (At one site, insulated ductwork was stored on the floor where it was damaged by rainwater.)

- Maintaining reasonable humidity conditions during construction. (Mold problems have occurred at some sites after carpets or gypsum board were installed in cold basements during periods of high humidity without dehumidification.)

- Designing HVAC air intakes to minimize water entry, sewer gas entry, minimize ponding from poorly drained condensate drains and sloped roofs.

**REMEDIAL ACTION**

Remediation of mold/fungal growth or contamination requires a focused approach to identify mold growth problems and to develop the appropriate measures for removal. A typical scope of work might include visual inspections, bulk and air sampling and analysis, identification of viable and nonviable spores, work plans for mitigation, decontamination, ambient air monitoring, remediation oversight and clearance testing to evaluate final project area spore levels. Early detection and appropriate remedial action is the key to a cost-effective solution.

Two documents that address remediation are *Mold Remediation in Schools and Commercial Buildings*, March 2001, EPA and *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*, New York City Department of Health, 2000. These guidelines are designed primarily for building managers, custodians and other personnel responsible for building maintenance.

Cleanup methods range from use of wet vacuums, to removal of contaminated building materials and furnishings. Once water damage has occurred, it is important to find the cause of moisture infiltration and fix it, then remove and restore affected building materials. In hiring a remediation contractor, the following factors should be considered:

- Insurance.
- Business history and references.
- Affiliation with reputable industry organizations (Disaster Kleenup International, National Air Duct Cleaners Association).
- Licensed, where applicable.
- Written proposal.
- Follows state-of-the-art practices and guidelines (NYC, EPA, ACGIH guidelines).

Always define the roles of the contractor, owner and/or third-party evaluator and clarify details such as cleaning methods, chemicals to be used, limitations and exclusions in the scope of work and clearance criteria. The EPA recommends scheduling remediation activities during off-hours when building occupants are less likely to be affected. According to EPA guidelines: “In some cases, especially those involving large areas of contamination, the remediation plan may include temporary relocation of some or all of the building occupants. The decision to relocate occupants should consider the size and type of the area affected by mold growth, the type and extent of health effects reported by the occupants, the potential health risks that could be associated with debris, and the amount of disruption likely to be caused by remediation activities.”

**About the Author**

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**For More Information**

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The Foundation also has made available three publications on the subject of mold. The first is *Mold: Cause, Effect and Response*. The second is *Preventing Losses from Moisture and Mold During Construction*. The third in the research series is *Mold Litigation: Prevention and Defense*. Copies are available for $10 each by calling (703) 534-8300, or they can be downloaded for free from [www.awci.org](http://www.awci.org).