

# **Mold Remediation: A Practical Approach**

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Excessive mold growth in indoor environments has become an increasing health and environmental concern as well as the subject of controversy and litigation. While human response to mold varies widely, no official exposure/response relationship exists. Neither are there currently any definitive clearance criteria or legislative guidelines for mold remediation, although a number of de facto standards are generally accepted. Work practices such as (1) containment and use of negative pressure for dust (spore) control, (2) three-stage decontamination procedures, (3) use of HEPA-filtered equipment, and (4) personal protection such as respirators and protective suits are very similar to those for asbestos abatement work. However, there are important differences that should be considered when selecting an environmental contractor to perform mold or microbial remediation services. We will begin by looking at the nature of mold infestations and then discuss existing guidelines and recommended work practices. Most important, we will look closely at how a mold remediation project differs from an asbestos abatement project, including the health and safety training requirements for workers and important contractor insurance coverage that should not be overlooked.

## **The Environmental Support Zone**

Three elements are required to support mold growth – water, food, and a stable environment. Aside from water leaks, water in this case can refer to high relative

humidity. If relative humidity is higher than 60%, carbon-based materials such as paper and wood products will absorb enough moisture to sustain and amplify mold growth.

Food sources may include unconfined cellulose (paper, dust) and wood products. A stable environment for mold translates to no sunlight, limited airflow, and minimal or no disruption. Although temperature is also a factor, the acceptable range for mold growth varies widely, depending upon the species.

### **A Warning Sign: Environmental Conditions and Human Responses**

Mold is indicative of a system or structural problem within a building that is likely to get worse if not treated. In a normal, healthy environment, the types and concentrations of fungal species found in indoor air should be identical to those present in the outdoor air (indicating proper air circulation). Certain species, however, can be indicative of HVAC system or construction problems. Some produce mycotoxins and are currently regulated in hospital settings. By identifying the type of organism(s) present, the source of the problem can usually be determined. Examples include the following:

- *Alternaria spp.* - HVAC system problems
- *Stachybotrys char.* - water and rot conditions (very prevalent)
- *Pencillium/Aspergillus spp.* (almost exactly alike) - soil and wood rot
- *Fusarium spp.* - cellulose/water rot

Effects from mold exposure can be immunological, toxicological, or infectious; however, from a medical perspective, no official exposure/response relationship has been

established. Human response to mold appears to vary widely; some people may have no reaction, while others may be extremely sensitive. For example, mold spores in the air may cause an infection in an existing wound that can't be treated with an antibiotic. Of particular concern are infants with developing respiratory systems, immunocompromised individuals, and the elderly. Some healthy adults may even contract severe or even life-threatening infection. When human health is at risk, failure to act can initiate stiff OSHA penalties (General Duty Clause) for the building owner. On the other hand, many of these same physical symptoms can be related to other widespread illnesses such as colds, influenza, and other allergies.

Mold litigation is also increasing. Last year, for example, a Travis County, Texas District Court jury awarded \$32 million to a Texas family in their fight against a major insurance company. This punitive award stemmed from the company's failure to take corrective action to remediate extensive mold growth, which ultimately caused severe, debilitating health problems for the family members. Because of this and litigious proceedings elsewhere, it is not surprising that some insurance companies are becoming increasingly willing to settle mold-related claims (due to the recognized impact on health) rather than letting them get to the litigation stage.

### **Mold Regulations**

In October 2001, California became the first state to pass mold legislation into law. The State's Toxic Mold Protection Act, Senate Bill 732 (SB 732), includes "groundbreaking regulations" that specifically address the toxic mold issue. It also provides guidelines for the following:

- **How much mold is harmful to our health**
- **How to assess and remediate toxic mold**
- **How to educate the public about toxic mold, as well as disclosures for the presence of toxic molds with respect to real estate transactions**

In addition, Assembly Bill 284 (AB 284) requires the California Research Bureau (CRB) to conduct comprehensive studies on health problems associated with toxic molds. Other states (e.g., Nevada, New Jersey, Maryland, Illinois, and Pennsylvania) have passed indoor air quality legislation with provisions and consideration for indoor mold growth, while still others have mold legislation pending. In New York, Senator Hillary Rodham Clinton sponsored an amendment to the Elementary and Secondary Education Act (ESSA) – an indoor air quality bill in the U.S. Senate that includes provisions for mold. Also in 2001, both the EPA and the New York City Department of Health published recommendations on mold remediation methods. There is also the possibility of some U.S. Public Health Service involvement. The industry and its regulators face the following major considerations:

- **What is an acceptable level of indoor fungi?**
- **How will the levels be determined?**
- **What sampling protocol should be used?** (Air samples? Surface samples? Both?)

In June 2002, Congressman John Conyers, Jr. (D-MI) held a press conference during which he unveiled the U.S. Toxic Mold Safety and Protection Act, HR 5040. At the time of the press conference, more than 40,000 people had signed an electronic petition in support of the bill at the Policyholders of America (POA) Web site. HR 5040, also known as the Melina Act, is very comprehensive in nature and is the nation's first federal bill introduced to address indoor mold growth.

The Melina Act, while designed with consumers foremost in mind, is a landmark bill with sweeping implications for IAQ professionals and professional remediators. The complete bill can be downloaded from the Internet at <http://www.house.gov>.

### **Mold Remediation: Guidelines**

One fact that experts agree on is that prior to any mold remediation activities, the source(s) of the water/moisture intrusion points must be identified and repaired. Although there are no current federal or state regulations for mold remediation methods or certifications of professionals involved with the remediation process, there are, however, several "peer reviewed and accepted" guidelines or *standards of care* (if you will) that exist which provide a good foundation for building owners, consultants, and contractors

when faced with mold contamination in buildings. These guidelines include, but are not limited to, the following:

- **Mold Remediation in Schools and Commercial Buildings** (EPA)
- **Assessment & Remediation of Fungi in Indoor Environments**  
(New York City Dept. of Health)
- **Bioaerosols: Assessment & Control** (The American Conference of Government Industrial Hygienists (ACGIH))
- **Standard Reference Guide for Professional Water Damage Restoration** (Institute of Inspection, Cleaning & Restoration's IICRC S500)
- **Assessment, Cleaning & Restoration of HVAC Systems** (ACR 2002 National Air Duct Cleaners Association, or NADCA)

### **Understanding the Guidelines For Mold Remediation**

The EPA mold guidelines were published in March 2001. In many respects, the EPA document mirrors the New York City Department of Health guidelines and, in fact, seems to contain the most frequently cited and consulted operative standards for mold remediation work plans/specifications prepared by both contractors and consultants. Both of these documents have established different levels of remediation that are determined by the size of the area impacted by fungal contamination.

The EPA guidelines established levels as follows:

1. Small = total surface area affected < 10 square feet
2. Medium = total surface area affected between 10 - 100 square feet
3. Large = total surface area affected > 100 square feet

In addition to establishing levels for remediation, the guidelines have established recommendations for cleanup methods as follows:

**Method 1: Wet Vacuum** - Wet vacuums are vacuum cleaners designed to collect water. They can be used to remove water from floors, carpets, and hard surfaces where water has accumulated. They should not be used to vacuum porous materials such as gypsum board. They should be used only when the materials are still wet, since wet vacuums may spread spores if sufficient liquid is not present. The tanks, hoses, and attachments for these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may stick to the surfaces.

**Method 2: Damp-Wipe** - Whether dead or alive, mold is an allergenic, and some molds may be toxic. Mold can generally be removed from nonporous (hard) surfaces by wiping or scrubbing with water, or water and detergent. It is important to dry these surfaces quickly and thoroughly to discourage further mold growth. Instructions for cleaning surfaces, as listed on product labels, should always be read and followed. Porous materials that are wet and have mold growing on them may have to be discarded. Since molds will infiltrate porous substances and grow on or fill in empty spaces or crevices, they can be difficult or impossible to remove completely.

**Method 3: HEPA Vacuum** - High Efficiency Particulate Air, or HEPA, vacuums are recommended for final cleanup of remediation areas after materials have been thoroughly dried and contaminated materials removed. HEPA vacuums are also recommended for cleanup of dust that may have settled on surfaces outside the remediation area. Care must be taken to ensure that the filter is properly seated in the vacuum so that all the air must pass through the filter. When changing the vacuum filter, contractors should wear PPE to prevent exposure to the mold that has been captured. The filter and contents of the HEPA vacuum must be disposed in strong, well-sealed plastic bags.

**Method 4: Discard** - Remove damaged materials and seal in plastic bags. Building materials and furnishings that are contaminated with mold growth and are not salvageable should be double-bagged using six-mil poly sheeting. These materials can then usually be discarded as ordinary construction waste. It is important to package mold-contaminated materials in sealed bags before removal from the containment area to minimize the dispersion of mold spores throughout the building. Large items that have heavy mold growth should be covered with poly sheeting and sealed with duct tape before they are removed from the containment area. 2

Another fact that “all the experts” will agree on is that the goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and keeps fungi-contaminated dust from migrating from the work area and entering an

occupied or non-abatement area. This protects the health of the building occupants as well as the workers performing the remediation. All of the published guidelines were designed to accomplish this.

### **The Mold Remediation Process:**

According EPA and NYC Dept. of Health guidelines, if visible mold growth is present, sampling is unnecessary. In specific instances, such as cases where litigation is involved, the source(s) of the mold contamination is unclear, or health concerns are a problem, you may consider sampling as part of your site evaluation (prior to remediation). Sampling may help locate the source of the mold contamination, identify some of the mold species present, and differentiate between mold and soot or dirt. Pre- and post-remediation sampling may also be useful in determining whether remediation efforts have been effective. 3

The first step in a successful mold remediation project is to make sure that the source of the moisture intrusion (what caused the microbial growth) has been properly identified and corrected. A thorough visual inspection of the areas is required in order to understand the “order of magnitude” of the visibly contaminated materials and their locations as well as preparation of a remedial work plan. One major problem with mold growth is that it is not always visible. Mold can grow behind walls and other hidden places in a building envelope, so it is critical that once you start the actual remediation process of those areas where visible contamination is present, you should have prudent engineering controls in

place to mitigate and prevent hidden contamination from spreading throughout your building.

In addition, because microbial growth can occur inside of HVAC systems, a visual inspection of the inside and/or surface sampling within supply ducts should be performed. If mold spores contaminate an HVAC system and this is not identified before remediation actions occur, then the existing mold spores may spew back into the area that was just cleaned when an HVAC system is re-energized following remediation work. If the HVAC system is contaminated, guidelines set forth under NADCA's ACR 2002 (referenced above) should be part of your remediation process work plan.

Some of the engineering controls contractors use to secure the environment and protect the building occupants as well as the workers doing the cleanup are very similar to those utilized in the asbestos abatement industry. This is because mold spores, like asbestos fibers, can travel on air currents and can quickly spread to other areas of a building through the normal and aggressive site conditions and activities of its occupants.

These controls include, but are not limited to, the following:

1. HEPA-equipped air filtration devices (AFDs), which filter (scrub) the air in the contaminated areas as well as assist in establishing a negative air pressure environment.
2. Polyethylene sheeting affixed to walls, ceilings, and floors (if applicable), which seal or contain the work areas from areas that are not to be abated.

3. Air locks and decontamination chambers that allow for worker ingress/egress, as well as preventing the migration of mold spores to areas not to be abated.

The EPA guidelines establish two types of containment for mold remediation based on the size of the areas impacted by mold growth. For *Small-Level* contamination, EPA documents indicate that no containment is needed. However, at a minimum, anyone remediating small amounts of mold growth should adhere to the NYC guidelines that would require at least covering the visibly contaminated materials with poly sheeting and using dust suppression methods to prevent emissions of mold spores during cleaning or removal activities. For *Medium- and Large-Level* mold contamination, the EPA has recommended the following:

***Limited Containment:*** Use poly sheeting ceiling to floor around affected areas, with a slit entryway and covering flap; maintain area under negative air pressure with HEPA AFDs. Block supply and return air vents within the containment area.

***Full Containment:*** Use two layers of fire-retardant poly sheeting with one air-lock chamber. Maintain area under negative pressure with HEPA AFDs exhausted outside of the building. Block supply and return air vents within the containment area. 4

In many of the peer reviewed and accepted guidelines, you will often see recommendations regarding the use of “professional judgment” as needed in some instances to determine prudent levels of personal protective equipment, containment, and

remedial options for each situation. Following are some factors to consider when selecting remediation options:

1. Is the moisture/water intrusion source from clean water, gray water, or black water? This is important because gray water and black water as defined by the IICRC S-500 document contain significant levels of contamination, which can supply the nutrients that microorganisms thrive on and/or contain pathogenic agents such as sewage which are considered grossly contaminated. When water damage is a result of these types of water, the remediation options must include sanitizing or disinfecting the work areas as well.
2. Is the HVAC system contaminated? If this is the case, remedial methods for biological contamination within an HVAC system must be included.
3. What is the location of the site requiring remediation? Is it occupied/unoccupied? Will the adjacent areas need to be unoccupied during remediation? Is there sensitive equipment that cannot be relocated?
4. What is the contaminating agent? What is the nature of the contaminated material? Understanding the contaminating agent assists in determining what level of respiratory protection is required for the job. In addition, it can also help to determine the “source/reservoir” for the microbial contamination. Remedial options are also determined when the impacted materials are porous or non-porous.
5. Is there any sign of structural damage from the mold contamination? Mold growth can eventually cause structural damage to a school or large building if a

- mold/moisture problem exists for a long time. In this instance, you may want to consult with a structural engineer or other professional with expertise in this area.
6. Communication with building occupants is another critical factor to consider when planning for mold remediation. The courts are being flooded with lawsuits involving mold and other indoor air quality issues. The manner in which a building owner/manager communicates and documents the various steps toward cleaning up mold contamination in an occupied environment can have a significant impact on liability exposure.
  7. Is the source of the water/moisture intrusion corrected? As stated in all the published guidelines, if the source of the mold growth is not identified and repaired, remediation efforts will not solve the problem.
  8. Are there other contaminants besides mold, i.e., asbestos, lead paint, or other hazardous materials in the work area? The existence of additional hazardous materials will definitely affect your remedial options. There may also be other factors to consider when evaluating remedial options. A lot depends on your individual situation.

### **The Difference Between a Mold Remediation Project and an Asbestos Abatement Project**

We have seen where many of the engineering controls utilized in the asbestos abatement industry have been adopted into the evolving mold remediation industry. There are many obvious similarities between these processes. Conversely, there are some obvious

differences between the two. The asbestos industry has been in existence for over 20 years. There are valid scientific data supporting the hazards and health effects of exposure to asbestos fibers that have enabled governmental agencies such as OSHA, EPA and NIOSH to establish threshold value limits, personal exposure limits, as well as acceptable ambient air levels for “re-occupancy” of asbestos contaminated areas.

Unfortunately, with mold, our health and safety agencies and industry professionals in the medical, occupational health, and industrial hygiene arenas are still conducting research on this controversial topic. Other differences from an asbestos abatement project are as follows:

- There are no current regulations for mold remediation methods.
- There are no training/certification requirements for contractors or workers performing mold remediation or consultants performing mold inspections testing and project oversight.
- The health and safety exposure risks for mold are different from asbestos.
- There are no formally recognized clearance criteria for mold remediation projects.
- Insurance coverage for mold remediation is normally not included in an asbestos contractor’s asbestos liability policy.
- Disposal of mold-contaminated materials is handled differently from disposal of asbestos materials.

**What is Post Remediation Testing?**

Due to the fact that there are no scientific data to support an acceptable level of exposure to mold, there are no current EPA or OSHA regulations or standards for airborne mold contaminants. So how do we know when the mold remediation/cleanup has been successful? The EPA guidelines clearly indicate the following:

1. You must have completely fixed the water or moisture problem.
2. You should complete mold removal. Use professional judgment to determine if the cleanup is sufficient. Visible mold, mold-damaged materials, and mold odors should not be present.
3. If you have conducted samples of the kinds and concentrations of mold and mold spores in the building, they should be similar to those found outside, once cleanup activities have been completed.
4. You should revisit the site shortly after remediation, and it should show no signs of water damage or mold growth.
5. People should be able to occupy or re-occupy the space without the health complaints or physical symptoms.
6. Ultimately, this is a judgment call; there is no easy answer. 5

The post remediation acceptance of a mold-contaminated space is yet another controversial and evolving topic, especially if you are a remediation contractor or an industrial hygiene firm that performs mold sampling/analysis. Both the EPA and the NYC guidelines indicate that sampling of any kind (air or surface) is not required. One thing I believe both would agree on is that the minimum criterion for post-remediation

acceptance of a contaminated space is for the area to be free of “visible mold contamination” by conducting a thorough visual inspection. Air and/or surface sampling may be used in conjunction with a thorough visual inspection, as long as the criteria for acceptable are reasonable and achievable.

Of course, none of the information listed above will be of any value if the selection of a remediation contractor is taken for granted. Building owners, property managers, and facility managers/engineers should strongly consider the following qualifications when selecting a mold remediation contractor:

- **Demonstrated experience/expertise in mold/microbial remediation**
- **Insurance covers all pollutants, with no exclusion for “microbial matters”**
- **Résumés of key project personnel such as project managers and supervisors demonstrate investment and commitment to this evolving industry by participation in various training courses and earning industry-recognized certifications from NADCA, IAQA, IAQC, NREP, and IICRC.**
- **Proof of written work practices and procedures specifically for microbial remediation**
- **Demonstrated expertise in the effective operation of HEPA-filtered equipment, including a written equipment operation program and written integrity testing program for HEPA equipment**

- **Documentation of OSHA-mandated safety programs i.e., respiratory protection programs, medical surveillance programs, fit test programs, etc.**

Worker health and safety training requirements include, but are not limited to, the following:

- **Bio-safety level training (BSL)** – modeled on Center for Disease Control (CDC) / National Institute of Health (NIH) protocols, protective measures, and how to recognize conditions of exposure to mold and fungi
- **HAZWOPER** - Hazardous Waste Operations and Emergency Response (29 CFR 1910.120)
- **AHERA** - Asbestos Hazard Emergency Response Act (40 CFR part 763)
- **Biocide Use Training** - proof of training on file for those who handle/apply biocides.
- **Blood-borne pathogens** – training on infectious nature of materials being handled (CFR 1910.1030)
- **Hazards communication** – training for handling/use of various chemicals (CFR 1910.1200)

Mold remediation is a new and evolving industry. There is no current consensus on exactly who is qualified to perform this work. Which existing industry is best qualified to make the transition from its current work practices to performing mold remediation?

Some of the suggested ones include restoration firms, disaster/catastrophic response firms, asbestos/lead abatement firms, or air duct cleaning firms, to name a few. 6

The big question is, **who is most qualified?** Therefore, I submit to you that when it comes to a defense counsel's argument that his client acted in a fair and reasonable manner, the selection process of your mold remediation contractor should be just as important how you selected your attorney, your medical experts, your industrial hygienist, your mechanical systems/energy consultant, or your building's systems expert.

### **Summary**

As different states take heed of the recent passage of the first mold legislation, California SB 732, many of us in the industry anticipate more legislation to come, certification requirements for those performing mold services, and eventually standards and regulations on mold remediation processes similar to what was passed in the asbestos industry two decades ago. In the meantime, the most practical approach is to adhere to the current industry guidelines (at minimum); be sure to document your actions as you continue in the remedial process; communicate properly with your tenants and building occupants; be as prudent in selecting your remediation contractor as you would other "experts;" and establish reasonable and achievable remediation goals. As the saying goes, "use lots of professional judgment!"

*The above paper is intended to provide a general overview of the toxic mold issue and microbial remediation. For additional information about MARCOR's nationwide mold seminars, to request a capabilities presentation or estimate, or simply to ask a question or share a comment, please feel free to call Steve Silicato toll free at 1-877-6-MARCOR or email to [silicato@marcor.com](mailto:silicato@marcor.com).*

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**Notes:**

**1, 2, 3, 4 & 5** are excerpts from various section of the EPA Document on **Mold Remediation in Schools and Commercial Buildings**

**6** is from an excerpt from “Pre-Qualifying a Mold Remediation Contractor,” an article written by Steven F. Goselin and published in the March edition of *Indoor Environment Connections*.