

Region Six Technical Update

Mechanical Issues

June 11, 2014



MOLD¹

SUMMARY

With the increase in flood events and reduced maintenance leading to the discovery of contaminated building materials during renovations, the issue of mold has been reopened in the medical, HVAC and occupational safety arenas.

Unfortunately, as I've stated in earlier communications, there are currently no standards which we can use to identify dangerous levels of mold on surfaces, or dangerous levels of exposure to molds. If, in the future, standards are set, I will pass that information on to you.

Should you encounter mold there are things you can do to protect yourself. This document briefly discusses the origin of mold, where to look for it, protective measures to take when performing remediation, limitations, and gives you a list of web sites to find more information.

MOLD – ORIGIN AND EPIDEMIOLOGY

Mold spores float through the indoor and outdoor air continually. When excessive moisture or water accumulates indoors, mold growth will often occur, particularly if the moisture problem remains undiscovered or un-addressed. To reproduce, molds produce spores. "Molds and mildew are fungi that grow on the surfaces of objects, within pores, and in deteriorated materials. They can cause discoloration and odor problems, deteriorate building materials, and lead to allergic reactions in susceptible individuals, as well as other health problems.²" When mold spores drop on places where there is available moisture, such as where leakage may have occurred in roofs, pipes, walls, plant pots, or where there has been flooding, they will grow and digest whatever material they landed on in order to survive. In the process they generate additional spores.

Not all mold is bad. *Penicillium roqueforti* is essential in the creation of blue cheese. Mold is the basis for medically active compounds including antibiotics, anti-cancer drugs, cholesterol inhibitors, psychotropic drugs, immunosuppressants and even fungicides. While mold and fungal products have been used in traditional and folk medicines, probably since pre-history, the discovery of penicillin by Alexander Fleming in 1928 is the most recognized use of mold.

The common health concerns from molds include hay fever-like allergic symptoms. Certain individuals with chronic respiratory disease (chronic obstructive pulmonary disorder, asthma) may experience difficulty breathing. Individuals with immune suppression may be at increased risk for infection from molds. If you or your family members have these conditions, a qualified medical clinician should be consulted for diagnosis and treatment. For the most part, one should take routine measures to prevent mold growth in the home.

¹Toxin producing mold. Photos from: <http://www.mold-info.net/mold-pictures.html> (March 2006)

²"Building Air Quality – A Guide for Building Owners and Facility Managers" EPA

“Is our mold toxic?” The term “toxic mold” is not accurate. While certain molds produce toxins (toxigenic), specifically mycotoxins, the molds themselves are not toxic, or poisonous. It is the mycotoxins that will hurt you. A mycotoxin is a toxic secondary chemical product and metabolite produced by molds. One mold species may produce many different mycotoxins, and the same mycotoxin may be produced by several species. Three deadly molds mycotoxins are:

- The toxin produced by *Stachybotrys chartarum* is the most deadly. It has been tied to diseases as minor as hay fever, to those as serious as liver damage, pulmonary edema, brain damage, nerve damage and even death. It has also been linked to severe illness in infants. Those with compromised immune systems, small children, and the elderly are highly susceptible to illness when they come in contact with this species of mold.
- *Cladosporium*, *Fusarium*, and *Penicillium*. These mold families have been connected to illnesses such as nail fungus, asthma, and also infections of the lungs, liver, and kidneys. *Fusarium* may cause gastrointestinal illnesses, and even illness which affect the female reproductive system. *Cladosporium* may produce pulmonary edema and emphysema.
- *Aspergillus* has over 160 species in its mold family and only 16 cause illness in humans, none of which are fatal if treated.

Hazards presented by molds, toxigenic and non-toxigenic, are considered equally significant. Some people are sensitive to molds. For these people, exposure to molds, even non-toxigenic ones, can cause symptoms such as nasal stuffiness, eye irritation, wheezing, or skin irritation. People with serious allergies to molds, may have severe reactions that include fever and shortness of breath. Some people with chronic lung illnesses, such as obstructive lung disease, may develop mold infections in their lungs.

In 2004 the Institute of Medicine (IOM)³ found there was sufficient evidence to link indoor exposure to mold with upper respiratory tract symptoms, cough, and wheeze in otherwise healthy people; with asthma symptoms in people with asthma; and with hypersensitivity pneumonitis in individuals susceptible to that immune-mediated condition.

In 2009, the World Health Organization issued additional guidance, the “WHO Guidelines for Indoor Air Quality: Dampness and Mould”⁴. Other recent studies have suggested a potential link of early mold exposure to development of asthma in some children, particularly among children who may be genetically susceptible to asthma development, and selected interventions that improve housing conditions may reduce morbidity from asthma and respiratory allergies.



Examples of mold contamination.

³ Source = Centers for Disease Control and Prevention (CDC)

⁴ http://www.euro.who.int/__data/assets/pdf_file/0017/43325/E92645.pdf

MOLD – REDUCTION

Mold spores are ubiquitous in the biosphere. In other words, due to the population and ease of reproduction, there is no practical way to eliminate all mold or mold spores in the indoor environment. The way to control indoor mold growth is to control moisture.

A common-sense approach should be used for any mold contamination existing inside buildings and homes. Numerous references exist with the expressed purpose of determining the potential adverse effects of these growths on the structure and not the inhabitants of the building. “Moisture Control in Buildings”⁵ is a comprehensive reference on the subject. This manual will not only guide the reader in learning where to look for contamination, it gives one information on constructing buildings in a manner that minimizes the future intrusion of mold. There is no practical way to eliminate all mold and mold spores in the indoor environment; the way to control indoor mold growth is to control moisture. Prevention steps include:

1. Fix the source of the water problem, leak, sources of moisture to prevent mold growth.
2. Reduce indoor humidity (to 30-60%) to decrease mold growth. Vent bathrooms, dryers, and other moisture-generating sources to the outside. Use air conditioners and de-humidifiers to decrease moisture content in the air. Increasing ventilation and use exhaust fans whenever cooking, dishwashing, and cleaning.
3. Prevent condensation: Reduce the potential for condensation on cold surfaces (i.e., windows, piping, exterior walls, roof, or floors) by adding insulation.
4. In areas where there is a perpetual moisture problem, do not install carpeting.
5. Clean and dry any damp or wet building materials and furnishings within 24-48 hours to prevent mold growth. If area/item is not completely dry within 48 hours, discard it.

MOLD DISCOVERY AND REMOVAL

All molds should be treated the same with respect to potential health risks and removal.

Exposure to some level of airborne mold is inevitable because molds are found indoors and outdoors. The need for Personal Protective Equipment (PPE), including respiratory, skin, and eye protection, must take into account the potential for exposure to mold as well as the potential for exposure to other hazardous substances that might be in the work area.

When determining the potential for exposure to mold, the activities being performed in relation to the mold-contaminated materials are at least as important, if not more so, than the size of the mold-contaminated area. For example, any remediation or other work that disturbs mold and causes mold spores to become airborne increases the degree of respiratory exposure. Actions that tend to disperse mold include breaking apart moldy porous materials such as insulation or wallboard; destructive invasive procedures to examine or remediate mold growth in a wall cavity; removal of contaminated wallpaper by stripping or peeling; and using fans to dry items or ventilate areas elevate exposure risks.

No Forest Service employee shall investigate or mitigate known mold contaminations without proper training and suitable personal protective equipment. See PPE section for details of the equipment needed for each mold investigation/removal task.

⁵ “Moisture Control in Buildings” Heinz R. Trechsel, original editor, ASTM, 1994, updated 2004, 2010

Task: Site Investigation

The general recommendation is that personal protective equipment (PPE) be worn by all persons performing site inspections, responding to known hazards, or engaging in recovery tasks/operations. While at the site minimize contact with contaminated materials and thoroughly wash exposed areas and clothing prior to entering non-contaminated areas or vehicles.

Task: Mold/Water Damaged Material Removal – Limited to 100 sf or less.

Personal protective equipment required. Work may be performed by properly trained and protected employees.

Discard all water-damaged materials, materials that are visibly coated with mold that cannot be properly cleaned, such as porous materials (e.g., carpeting, drywall, insulation), and materials that have been wet for more than 48 hours.

Minimize dust disturbance to reduce the spread of fungal spores.

Wrap and seal the items that will be discarded in plastic bags or sheets to reduce the spread of spores. These materials can usually be discarded as ordinary debris.

Provide natural or local exhaust ventilation during all cleaning steps.

Clean hard and non-porous materials using a detergent. After rinsing, if needed, disinfect with an appropriate biocide such as bleach.

After an area has been cleaned and is completely dry, vacuum the area with a high-efficiency particulate air (HEPA) vacuum. HEPA vacuums are also recommended for cleaning up dust that may have settled on surfaces outside the work area.

Task: Mold Remediation – Small Areas (up to 30 sf of visible mold growth)

The work area should be unoccupied. It is recommended that the building be vacant and well ventilated, particularly while detergents are being used. Containment of the work area is not necessary. Use dust suppression methods (e.g., misting (not soaking) surfaces prior to remediation). Clean and/or remove materials and seal materials being removed in plastic bags. The work area and areas used by remediation workers for egress should be cleaned with a damp cloth or mop and a detergent solution.

Task: Mold Remediation – Large Areas (Visible mold growth exceeds 30sf)

The building shall be vacated. Consult with industrial hygienists or other environmental health and safety professionals with experience performing microbial investigations and/or mold remediation in order to determine the viability of remediation. If mold removal is feasible, a Contractor shall be hired to develop a suitable mold remediation plan and perform the work.

The remediation plan to address: work area isolation, the use of exhaust fans with HEPA filtration, and the design of airlocks/decontamination room.

Verify remediation plan includes cleaning of building HVAC systems and ductwork.

Task: Mold Remediation – in HVAC Systems

The building shall be vacated. Consult with industrial hygienists or other environmental health and safety professionals with experience performing microbial investigations and/or mold remediation in order to determine the viability of remediation. If mold removal is feasible, consult with the HVAC and ductwork manufacturer (if duct board or internally insulated) to determine which biocide they recommend for use on their system and components, such as cooling coils and condensation pans. All biocides shall be Environmental Protection Agency (EPA) registered with the and be recognized as highly effective against “Class II” biohazards and pathogenic fungus and mold. A Contractor shall be hired to develop a suitable mold remediation plan and perform the work.

For extensively contaminated areas (i.e., > 10 square feet of contamination), air monitoring with the HVAC system running should be conducted prior to building re-occupancy.

PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment “PPE”, is equipment worn to minimize exposure to hazards and reduce the potential for serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, biological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits.

Personal protective equipment should be rated for use, of a safe design and construction, and should be maintained in a clean and reliable fashion. It should fit well and be comfortable to wear, encouraging worker use.

Personal protective equipment is required when an employee will be encountering mold or other contaminant at a site.

Minimum Personal Protective Equipment for Site Visits

1. Hard hat for overhead impact or electrical hazards
2. Eye protection with side shields
3. Gloves chosen for job hazards expected (e.g., heavy-duty leather work gloves for handling debris with sharp edges and/or chemical protective gloves appropriate for chemicals potentially contacted)
4. ANSI-approved protective footwear
5. Respiratory protection as necessary—N, R, or P95, filtering facepieces may be used for nuisance dusts (e.g., dried mud, dirt and silt) and mold (except mold remediation). Filters with a charcoal layer may be used for odors.

Personal Protective Equipment for Mold/Water Damaged Material Removal and Small Area Mold Remediation

1. Hard hat for overhead impact or electrical hazards.
2. Non-vented goggles.
3. Gloves chosen for job hazards expected (e.g., heavy-duty leather work gloves for handling debris with sharp edges and/or chemical protective gloves appropriate for chemicals potentially contacted).
4. ANSI-approved protective footwear .

5. Protective clothing (e.g., disposable coveralls) to prevent cross contamination and skin contact with mold and chemicals.
6. Respiratory protection required. Employee to wear an N, R or P95 respirator; either a half-face or full-face N, R, or P 95 respirator. Charcoal-impregnated filters may be used for odors.



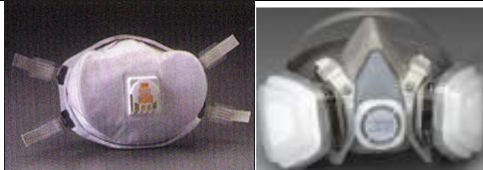
NIOSH Approved Masks

There are several different types of mold safety masks available. The type of masks available are briefly described in the following information paragraphs.

N-95 Respirator Mask – filters out 95% of all airborne particles, including mold spores.

N-99 Respirator Mask – filters out 99% of all airborne particles, including mold spores.

N-100 Respirator Mask – filters out 99.97% of all airborne particles, including mold spores.

OSHA Approved Respirators			
			
“Moldex” 2300, N-95 Respirator w/ Exhalation Valve	“Moldex” 2600, N-95 Respirator	“3M”, N-100 mask (left) and “3M” 5000 series mask (right) with P-100 filters	

EMPLOYEE TRAINING AND SAFETY

According to FSH 6709.11, the Health and Safety Code Handbook, Chapter 20 – Work Projects and Activities, prior to undertaking a project such as mold remediation, each employee must have a:

1. Job hazard analysis (JHA) that indicates they have a suitable level of experience, training and skill to safely complete the task.
2. Appropriate respiratory protection, the physical ability to perform the work and sufficient knowledge to use the equipment properly. Refer to 29 CFR 1910.134.
3. The proper training in the use, fit, maintenance, and storage of respirators and their limitations. The ability to ensure that respirators are National Institute of Safety and Health (NIOSH) certified, regularly inspected, cleaned, and disinfected or destroyed.
4. The experience and knowledge to obtain and understand the Material Safety Data Sheets for any chemical cleaners or disinfectants. The ability to recognize and react to the signs and symptoms of overexposure, and the ability to obtain any materials needed to address an accidental release (spill).

MSDS

A material safety data sheet (MSDS) is a required document that contains information for the safe handling, use, storage and disposal of chemicals. This information needs to be obtained,

and understood, by each person using any type of chemical agents. An MSDS, according to OSHA's CFR 1910.1200, exists for all potentially hazardous chemicals. That same regulation requires the MSDS be made readily accessible to employees who may come in contact with chemicals in the workplace.

NIOSH approved.

The National Institute for Occupational Safety and Health (NIOSH) is a part of the Centers for Disease Control and Prevention (CDC). NIOSH is the U.S. federal agency that conducts research and makes recommendations to prevent worker injury and illness. They approve, for example, personal protective equipment, verifying that it performs as expected and as rated. Respirators and personal protective clothing are both NIOSH rated.

ANSI, ASTM approved.

ANSI, the American National Standards Institute, is the Federal Agency that determines safety specifications and performance requirements for protective footwear, among other products. ANSI works with ASTM International (formerly known as the American Society for Testing and Materials), which develops and delivers product standards. ANSI and ASTM's footwear and outerwear standards are intended to minimize the risk of sustaining an injury.

Footwear shall be ANSI approved.

LINKS AND REFERENCES

ASTM International: <http://www.astm.org/>

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC):

- "Molds in the Environment" Fact sheet - www.cdc.gov/mold/faqs.htm
- Emergency Preparedness and Response - www.bt.cdc.gov/disasters/mold
- Mold Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes and Major Floods - <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5508a1.htm>

EPA indoor air quality site. <http://www.epa.gov/iaq>

EPA "Mold Remediation in Schools and Commercial Buildings":
http://www.epa.gov/mold/mold_remediation.html

Federal Emergency Management Agency (FEMA): www.fema.gov

Occupational Safety and Health Administration (OSHA): www.osha.gov

"Building Air Quality: A Guide for Building Owners and Facility Managers"
<http://www.epa.gov/iaq/largebldgs/baqtoc.html>

CONCLUSION

No health-based standards (e.g., OSHA or EPA standards) or exposure limits (e.g., NIOSH recommended exposure limits) for indoor airborne concentrations of mold, mold spores or other

biologic agents exist. Differences in season; climatic and meteorological conditions; type, construction, age, and use of the building and ventilation systems; and differences in measurement protocols used in various studies make it difficult to interpret sampling data relative to information from the medical literature. Therefore, it is not possible to measure the mold level in an environment and make a determination as to whether the level is low enough to be safe or high enough to be associated with adverse health effects.

For the majority of persons, undisturbed mold is not a substantial health hazard. Mold is a greater hazard for persons with conditions such as impaired host defenses or mold allergies. To prevent adverse health effects from disturbed mold, persons should 1) avoid areas where mold contamination is obvious; 2) use environmental controls; 3) use personal protective equipment; and 4) keep hands, skin, and clothing clean and free from mold-contaminated dust.

Thank you,



Luahn Simms
ASHRAE, IAPMO, ICC, NFPA
Mechanical Engineer
Region Six Facilities Group