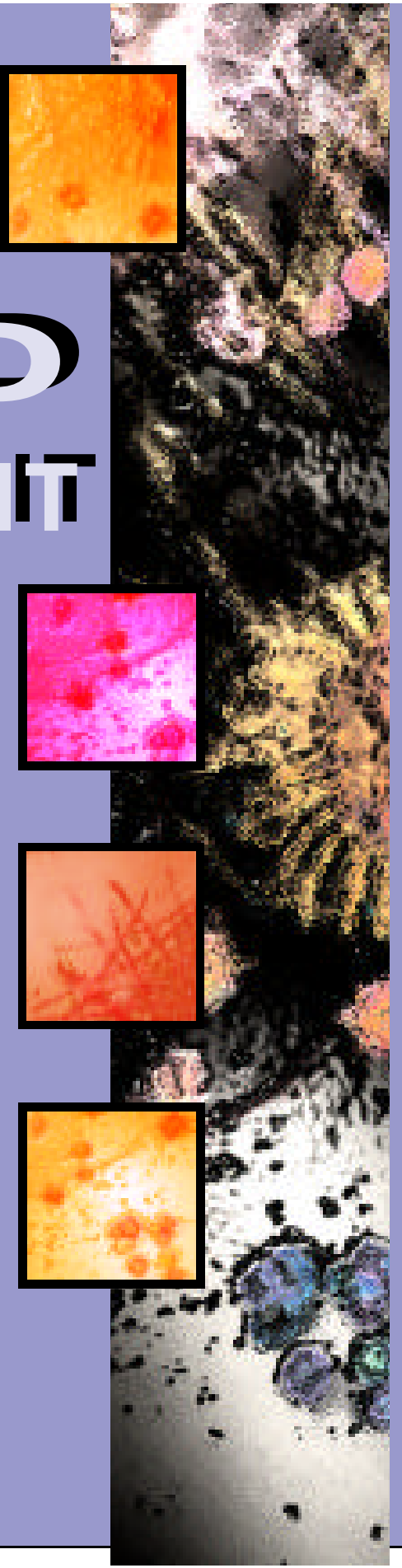
Mold Action Kit



A RESOURCE FROM:

NATIONAL APARTMENT ASSOCIATION

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America's leading advocate for quality rental housing.

August 8, 2001

Dear NAA Member:

In our on-going effort to keep members informed about industry-related issues, I am pleased to present you with this complimentary copy of the National Apartment Association (NAA) Mold Action Kit. In it you will find a compilation of resources from NAA, government agencies and private contributors that will assist your company in managing mold issues at your apartment communities.

You are free to duplicate any piece of this kit for use within your company. Please, however, limit distribution to NAA members only. As more information becomes available, it will be posted in the members only section of the NAA website http://www.naahq.org.

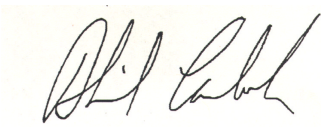
This kit is one step in the NAA Action Plan for Mold that also includes:

1. A state mold lease addendum – Available now through Blue Moon Software for the states where NAA offers lease forms. (Contact 512/322-0460).
2. Certified Apartment Maintenance Technician (CAMT) training on correcting water intrusion and how to deal with mold – Fall 2001
3. NAA Education Foundation video training program for mold remediation and crisis management – Available November 2001
4. NAA/National Multi Housing Council (NMHC) Operations and Management Plan – Expected completion Fall 2001

I would like to thank the following for their contributions to this kit:

- Dr. Eileen Lee and Shari Solomon of NAA/NMHC,
- John Manly of Freberg & Manly and
- The U.S. Environmental Protection Agency for providing complimentary copies of the Indoor Air Quality Problem Solving Wheel.

The National Apartment Association hopes your company finds this kit useful.



Phil Carlock, CAPS, CPM
2001 President

Mold Action Kit
August 2001

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Ten Things You Should Know About Mold

1. Potential health effects and symptoms associated with mold exposures include allergic reactions, asthma, and other respiratory complaints.

2. 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.

3. If mold is a problem in your home or school, you must clean up the mold and eliminate sources of moisture.

4. Fix the source of the water problem or leak to prevent mold growth.

5. Reduce indoor humidity (to 30-60%) to decrease mold growth by: venting bathrooms, dryers, and other moisture-generating sources to the outside; using air conditioners and de-humidifiers; increasing ventilation; and using exhaust fans whenever cooking, dishwashing, and cleaning.

6. Clean and dry any damp or wet building materials and furnishings within 24-48 hours to prevent mold growth.

7. Clean mold off hard surfaces with water and detergent, and dry completely. Absorbent materials such as ceiling tiles, that are moldy, may need to be replaced.

8. Prevent condensation: Reduce the potential for condensation on cold surfaces (i.e., windows, piping, exterior walls, roof, or floors) by adding insulation.

9. In areas where there is a perpetual moisture problem, do not install carpeting (i.e., by drinking fountains, by classroom sinks, or on concrete floors with leaks or frequent condensation).

10. Molds can be found almost anywhere; they can grow on virtually any substance, providing moisture is present. There are molds that can grow on wood, paper, carpet, and foods.

Source: United States Environmental Protection Agency – Mold Resources
http://www.epa.gov/iaq/pubs/moldresources.html

NMHC National Multi Housing Council

NAA National Apartment Association

July 19, 2001 (revised)

Mold in Apartment Buildings

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- In recent years, comparative risk studies performed by the U.S. Environmental Protection Agency (EPA) and its Science Advisory Board have consistently ranked indoor air pollution among the top five environmental risks to public health. Growth of molds (fungi) is a contributing factor to indoor air quality (IAQ) pollution and one that has brought new concern to the apartment industry.

- Depending on the person affected and/or the type of mold, the adverse health effects associated with exposure to molds can vary from hay-fever like allergy symptoms to life-threatening respiratory infections.

- While there are no controlling regulatory requirements for assessment and remediation of mold growth, EPA, local health departments and industry associations provide useful and comprehensive guidelines to consider.

- There are several steps available to stem liability, in terms of minimizing the likelihood of mold infestation and dealing appropriately with residents' concerns/complaints.

- If a lawsuit is filed, the property owner could be confronted with several possible legal causes of action. Mold contamination has resulted in several well-publicized lawsuits brought by residents against apartment owner/managers, claiming both personal and property damage caused by mold in their apartments. A sampling of recently published litigation, verdicts, and settlements is provided.

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ACKNOWLEDGMENTS

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MOLD IN APARTMENT BUILDINGS

Please understand that the information discussed in this guidance is general in nature and is not intended to be legal advice. It is intended to assist owners and managers in understanding this issue area, but it may not apply to the specific fact circumstances or business situations of all owners and managers. For specific legal advice, consult your attorney.

I. INTRODUCTION

In recent years, comparative risk studies performed by the U.S. Environmental Protection Agency (EPA) and its Science Advisory Board have consistently ranked indoor air pollution among the top five environmental risks to public health.[1] Despite strides that have been made in improving general air quality under the Federal Clean Air Act,[2] EPA studies of human exposure to pollutants indicate that indoor air levels of many pollutants, such as carbon monoxide, nitrogen dioxide and volatile organic compounds (VOCs), may be two to five times, and occasionally, more than 100 times higher than outdoor levels.[3] These levels of indoor air pollutants are more likely to pose a threat to health since the average person spends as much as 90 percent of the time indoors.[4] Poor indoor air quality (IAQ) is due, at least in part, to newer building technologies that in an effort to improve energy conservation, have resulted in tighter buildings with less air exchange; in many high rise commercial buildings there are no operational windows. Pollutants found in outdoor air, including pollen, dust, automobile exhaust, and other contaminants are often directly imported into buildings through the heating, ventilating and air-conditioning (HVAC) system and combine with VOCs, off gassing from furniture, rugs, building materials, and chemicals used in the residential environment.

Growth of molds is a major contributing factor to IAQ pollution and one that has brought new concern to the apartment industry although there are currently no federal standards regarding molds in indoor air. Property owners are seeking to understand what is required when mold contamination is discovered. The nature and extent of such contamination have resulted in several well-publicized lawsuits brought by residents against property owners and managers, claiming both personal and property damage caused by mold.

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[1]U.S. Environmental Protection Agency (EPA), *Office of Air and Radiation, Indoor Environments Division's Indoor Air Quality (IAQ) Site* (last modified Nov. 13, 2000) <http://www.epa.gov/iaq/>.

[2]Clean Air Act, 42 U.S.C. §7401 (1972).

[3]EPA, *supra* note 1.

[4]Id.

Molds, also referred to as mildew and fungi, are found throughout the environment. Many species are commonly found on the skin of healthy people as well as in air and soil. Molds can be found almost anywhere moisture is present. Molds in soil play a key role in the breakdown of leaves, wood, and other plant debris. Molds also are used for activities such as making cheese, wine, beer, and bread. Spores (the reproductive bodies by which molds propagate) are commonly present in the air. While these organisms are ubiquitous, they require favorable conditions in a building environment to flourish and create a potential threat to human health.

When water enters the building "envelope" or other situations occur, such as an improperly cycling HVAC system, which create a high relative humidity inside the building, conditions are favorable to activate the growth of any mold spores which may be present. In the residential environment, molds can be found growing in wallboard, carpets, ceiling tiles, books and papers, plywood, wooden studs, and wooden furnishings.[5] Molds not only cause discoloration and odor problems but may actually lead to the deterioration of building materials.

Mold growth can be associated with: leaking roofs; pipe leaks; sewage backups; floods; high humidity; heating, air conditioning and ventilation systems; construction design defects in the building envelope; and water-damaged building materials.

As long as moisture is present, molds will grow; without moisture, molds cannot reproduce. It is through undiscovered or ignored water damage problems that these organisms can become a very serious IAQ and health issue. The presence of standing water is not required for mold growth to occur. High relative humidity combined with the hygroscopic properties (the tendency to absorb and retain moisture) of certain building surfaces may allow sufficient moisture to accumulate.[6]

The conditions necessary for mold growth to occur on surfaces are:

- **temperature range between 40°-100° F;**
- **mold spores;**
- **nutrient base (something the organism can metabolize, such as cellulose in wood, paper and ceiling tiles, or dirt in carpets and hidden areas, paint, etc.); and**
- **moisture.**[7]

[5]Indoor Air Solutions, Inc., *Major Causes of Poor Indoor Air Quality* (last modified Aug. 15, 2000) <http://www.stachybotrys.com/article_1.htm>.

[6]Building Air Quality, *Mold and Mildew* (visited Dec. 10, 2000) <http://baq1.com/mold.htm>.

[7]EPA, *Building Air Quality, A Guide for Building Owners and Facility Managers, Appendix C,* 141, EPA/400/1-91/033 (Dec. 1991).

State and local legislative activities

While there are currently no federal standards regarding molds, States legislatures have begun to address mold in apartment buildings. Three bills were introduced in the California state legislature in February 2001 which deal with molds.

A.B. 284[8] would require the department to establish a mold training and education program. This program would include Web site services to provide public education, surveillance of local complaints, training seminars for local government officials, and the convening of a discussion group made up of experts to evaluate fungal contamination in buildings. The bill would provide for a specified meeting of various officers and experts respecting the health aspects of molds. This bill has passed the Assembly and is currently pending in the Senate.

Another bill, The Toxic Mold Prevention Act,[9] which originally sought to add the presence of mold on any interior wall, floor, ceiling, or any portion thereof, to the list of conditions that constitute a substandard building, and required the California Department of Health Services (CDHS) to establish permissible exposure limits to molds in indoor environments, has been amended in the Judiciary Committee. Through the work of California real estate groups including the California Apartment Association and NMHC, the changes to the bill include: (1) the removal of any reference to mold within the health and safety code, thus not making the presence of mold in a unit a condition that constitutes substandard housing; (2) additional language that states a landlord shall not be obligated to conduct a test to determine whether the presence of molds exceeds the permissible exposure limits; (3) the requirement of CDHS to convene a task force that shall advise CDHS on the development of standards, which shall be comprised of representatives of public health officers, environmental health officers, code enforcement officers, experts on the health effects of molds, medical experts, industrial hygienists, mold abatement experts, affected consumers, which include residential, commercial, and industrial tenants, homeowners, environmental groups and attorneys and affected industries, which include, but are not limited to, residential, commercial and industrial building proprietors, managers or landlords, builders, and insurers; (4) additional language which states that an owner shall not be required to utilize a third-party specialist to test or remediate mold from a building; (5) a revision of the language which had mandated CDHS establish exposure limits, to the requirement of the CDHS to convene a task force to consider the feasibility of adopting permissible exposure limits; (6) a requirement by rental property owners to provide a CDHS approved disclosure pamphlet to tenants; and (7) the re-writing of the disclosure language to require a landlord to disclose the presence of mold to prospective and existing tenants only when the owner (a) knows or has reasonable cause to believe mold is present in that unit and (b) that mold exceeds the permissible exposure limits. At the same time, the bill will not require an owner to perform a test to determine whether the permissible exposure limits have been exceeded. Owners will be exempt from providing written disclosure if the mold is remediated according to the mold remediation standards adopted by CDHS in conjunction with the Task Force. These specific disclosure

[8]A.B. 284, 2000-2001 Leg. Sess. (Cal. 2001).

[9]S.B. 732, 2000-2001 Leg. Sess. (Cal. 2001).

requirements will not be required until the time that CDHS develops standards. While the bill will continue with language that requires CDHS to develop mold remediation and identification standards, CDHS must now do this with guidance from the Task Force, which will include rental property owner and manager representatives. This bill is steadily advancing through the legislature.

The San Francisco CA Board of Supervisors amended the Health Code to include mold growth to the list of prohibited nuisances.[10] Under the amended ordinance, Aany visible or otherwise demonstrable growth of mold or mildew in the interiors of any buildings or facilities@ would require abatement and removal of the nuisance, within 30 days, by the property owner. This addition to the nuisance provision would make any mold growth in a property negligence *per se*. Under this cause of action, the plaintiff need not prove the requirements that would otherwise be necessary for recovery under the negligence standard. Recovery may be had on a theory of negligence *per se* when the harm resulting from the violation is of the type that the statue is designed to prevent, the plaintiff is a member of the class of persons sought to be protected by the statute, and the violation is the proximate cause of the plaintiff=s injuries. The ordinance is effective July 15, 2001.

Legislation in Texas requires that the Texas Board of Health (Board) develop voluntary IAQ guidelines for publicly owned or leased buildings. In establishing the guidelines, the Board is to consider such things as: the potential chronic effects of air contaminants and insufficient ventilation, the potential costs of both long-term and short-terms healthcare on human health that may result from exposure to indoor air contaminants, and the potential costs of compliance with a proposed guideline.[11]

The state of Maryland enacted legislation[12] addressing occupational exposure to mold in office buildings. The law establishes a task force that will make recommendations on regulations to protect workers from HVAC-related illnesses. The task force is to submit a final report of its findings and recommendations by July 1, 2002.

II. EXPOSURE TO MOLD

When moldy materials (i.e., wall boards and carpets) are damaged or disturbed, mold organisms and associated products are released into the air. Exposure to spores can occur through inhalation or direct contact. Some molds produce toxic chemicals called mycotoxins which may be aerosolized and contaminate a building's air space, even in areas which appear to be free of mold infestation. Inhalation of mycotoxins is a much more potent route of exposure compared with ingestion; adverse health effects have been observed in individuals who touched moldy surfaces, suggesting that the toxins can also be absorbed

[10]Ordinance 010269 (nuisance code revision), City and County of San Francisco (June 2001).

[11]TX Health and Safety Code, Tit. 5, Ch. 385.

[12]MD Code, Chapter 591.

through the skin.[13]

III. COMMON MOLDS FOUND IN BUILDINGS

Molds most commonly found in buildings with water intrusion include *Stachybotrys, Aspergillus, Penicillium*, *Cladasporium,* and *Fusarium*, among others. These species can produce a wide variety of mycotoxins; *Stachybotrys* alone produces over 163 different mycotoxins. Even in low concentrations, some of these mycotoxins may cause adverse health effects including skin irritation, pathogenic disease, cancer and immune disorders. Some molds can produce several toxins while other molds produce mycotoxins only under certain environmental conditions. The presence of mold in a building does not necessarily mean that mycotoxins are present or that they are present in quantities sufficient to pose health consequences. *Aspergillus flavus*, a common indoor mold, produces aflatoxins, notoriously potent animal carcinogens. *Penicillium*, while unable to produce aflatoxin, may produce more than 100 different classes of mycotoxins.[14] More than 200 mycotoxins have been identified; scientists have characterized the biological activity of very few of these compounds. According to the EPA guidance, "Mold Remediation in Schools and Commercial Buildings," more studies are needed to gain a clearer picture of the human health effects associated with exposure to mycotoxins. At this point, basic questions such as the toxic dose associated with a particular exposure route (e.g., inhalation, ingestion, dermal) have yet to be answered.

The U.S. Centers for Disease Control and Prevention (CDC) has recently retracted a 1997 report which described a causal relationship between the presence of *Stachybotrys* in the residential environment and the development of acute idiopathic pulmonary hemorrhage (AIPH; bleeding of the lungs) in infants in Cleveland, OH.

The CDC convened two multi disciplinary working groups to research a possible connection between AIPH and the mold *Stachybotrys,* found in the victim's residential environment, prior to releasing their report. Serious questions were raised about the accuracy of the report and in March 2000, CDC issued a second report which concluded that "the available evidence does not substantiate the reported epidemiological associations—between household water damage and AIPH or between household fungi and AIPH—or any inferences regarding causality."[15]

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[13]Alexander Robertson IV, *Microbiological Contamination Litigation A/k/a 'The Mold Monster',* 8 Mealey's Emerging Toxic Torts 23, 26 (Nov. 24,1999).

[14]Id.

[15]U.S. Centers for Disease Control and Prevention (CDC), *Update: Pulmonary Hemorrhage/Hemosiderosis Among Infants-Cleveland, OH, 1993-1996,* 49 Morbidity and Mortality Weekly Report 180 (2000).

A number of factors contributed to the CDC's conclusions that *Stachybotrys* was not clearly associated with AIPH. One of the most telling factors was that in homes classified as water damaged, and in control homes with no water damage, the presence of *Stachybotrys* was identified in similar percentages in both. Forty-three percent of control homes (no apparent water damage, no sick children) had detectable surface contamination with *Stachybotrys*. CDC further indicated that exposure to tobacco smoke in combination with exposure to *Stachybotrys* may increase an infant's risk of pulmonary hemorrhage, as case infants were eight times more likely than control infants to have been exposed to environmental tobacco smoke. Recently revealed internal CDC documents indicate that links to insecticides, (a roach bomb improperly used in a child's bedroom) may have been responsible for the fatality attributed to mold.[16] The CDC retraction of its original report and its subsequent failure to fully disclose the epidemiological findings related to pesticides have created considerable public confusion. Many people believe that CDC has conclusively proved the *Stachybotrys* - AIPH connection when this is clearly not the case.

This CDC report is the most recent study to conclude that *Stachybotrys* is more frequently found in indoor environments than originally believed. While the initial studies failed to substantiate a link between *Stachybotrys* and pulmonary hemorrhaging, the etiology of this cluster of AIPH cases is still unresolved. Thus, "CDC will continue to consider possible associations between AIPH and many possible etiologies, including household water damage or exposure to environmental hydrophilic fungi/molds such as *Stachybotrys chartarum*."[17]

A. Identification

It is difficult to identify types of mold through visual inspection of a contaminated surface alone; a definitive identification requires laboratory analysis. The list of molds most commonly found in water-damaged buildings, provided below, is not intended to be a complete description of all aspects of growth.[18] Rather, colors and certain colony characteristics that are useful for identifying some fungi are included.

- *Stachybotrys chartarum (a.k.a. Stachybotrys atra)* has received much notoriety in the media through high profile closings of both public and private buildings, schools,

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[16]Byron Harris, *Experts Don't Agree on Mold Study*, (Dallas/Fort Worth News, WFAA channel 8 broadcast, April 28, 2001).

[17]Id.

[18]New York City Department of Health (NYCDOH), *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (Apr. 2000) <http://www.ci.nyc.ny.us /html/doh/html/epi/moldrpt1.html#exec>; *see also*, Medical Mycology Research Ctr., University of Texas (last updated Jan 24, 2000) <http://www-fungus.utmb.edu/mycology/thefungi.html>.

courthouses and hospitals.[19] *Stachybotrys* is a greenish-black mold that can grow on materials with a high cellulose content that are chronically moist or water damaged due to excessive humidity, water leaks, condensation, or flooding. Common areas for this mold growth are water soaked wood, ceiling tiles, wall paneling, behind vinyl wallpaper, unpainted wall board (sheetrock) surfaces, cotton items, cardboard boxes, and stacks of newspapers.

- *Aspergillus* colonies are rapid growing, woolly to cottony in appearance, typically in some shade of green, brown, or black.

- *Penicillium* colonies are rapid growing, flat, velvety, woolly, or cottony in appearance, initially white, becoming blue green, gray green, olive gray, or some similar color.

- *Cladasporium* colonies are moderately rapid growing, spreading, velvety to woolly in appearance, grayish green to olive-green shade.

- *Fusarium* colonies are rapid growing, woolly to cottony in appearance, flat, spreading, white, cream, tan, cinnamon, yellow, red to violet, or purple.

Almost without exception, an extended saturation time and/or consistently high levels of humidity are required for *Stachybotrys* to proliferate. In sharp contrast, single or sudden water damage events that occur where drying of d material takes place more quickly tend to support the growth of fungi such as *Penicillium* and *Aspergillus*.[20]

Hidden mold

In some cases, however, indoor mold may be growing on hidden surfaces (e.g., the backside of dry wall, wallpaper, or paneling, the top of ceiling tiles, the underside of carpets and pads) and thus less obvious during visual inspection. Hidden mold growth may be suspected if a building smells moldy but no mold growth is visible, or if the building has experienced water damage and residents have reported "off odors". Other locations of hidden mold may include: pipe chases and utility tunnels (with leaking of condensing pipes); walls behind furniture; condensate drain pans inside air handling units; porous thermal or acoustic liners inside ductwork; or roof materials above ceiling tiles (due to roof leaks or insufficient insulation).

The investigation of hidden molds requires extreme caution since the investigation may lead to the disturbance and subsequent dispersal of mold and mold products. Personal protective equipment (such as gloves, goggles, dust masks, respirators, and disposable protective

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[19]CDC, *supra* note 13.

[20]Aerotech Laboratories Inc., *IAQ Remediation* (last viewed Jan. 4, 2001) <http://www.aerotechlabs.com/Library/iaqremed.htm>.

clothing) is necessary during the investigation. Thus, if you believe that there is hidden mold present, hiring an experienced professional should be considered.

B. Odor

Actively growing molds produce mycotoxins, including a wide range of VOCs, consisting mainly of alcohols, ketones, aldehydes, acids, hydrocarbons, and aromatics. These chemicals are typically what cause the characteristic musty or dank smell which people associate with mold growth. Odor thresholds (that is the level at which a person can detect an "off odor" in the air space) for some VOCs are as low as one part per trillion.[21]

C. Allergic reactions to mold

While exposure to mold is not healthy for anyone,[22] not all people who are exposed to mold will have health problems. The health effects of indoor mold experienced by residents are diverse; depending on the types of mold, the amounts of mold, the types and amounts of certain metabolites produced by the molds, and the susceptibility of an exposed individual.[23] Because all of these factors can vary considerably over time and from person to person, the extent and severity of health problems due to any specific indoor mold situation is unpredictable. The common health concerns from molds include allergic symptoms resembling hay-fever. Certain individuals with chronic respiratory disease (including asthma) may experience difficulty breathing. People with allergies may be more sensitive to molds. People with immune suppression or underlying lung disease are more susceptible to infection by molds.

> Typical symptoms from exposure to certain molds include: respiratory problems such as wheezing and difficulty in breathing; nasal and sinus congestion; burning eyes, watery, reddened, blurry vision, light sensitivity; dry, hacking cough; nose and throat irritation; shortness of breath; skin irritation; central nervous system problems (constant headaches, memory loss, and mood changes); aches and pains; fever.

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[21]Robertson, *supra* note11, at 27.

[22]California Department of Health Services (CDHS), *Mold in My Home: What Do I Do?* (Mar. 1998) <http://www.cal-iaq.org/mold9803.htm>.

[23]Minnesota Department of Health (MDH), *Indoor Mold: Health Hazard Identification and Control* (Mar. 2001) <http://www.health.state.mn.us/divs/eh/aialr/iair/moldslide/ moldtext.html>.

The health effects from exposure to certain species of fungus can be quite serious and can include life-threatening respiratory infections, allergies, asthma, nervous and immune system damage, hypersensitivity diseases, and others.[24]

D. Recent studies

While it is undisputed that certain molds cause harm to human health, scientific questions remain as to the level of harm mold exposure causes humans through inhalation in an indoor environment. While some scientists claim that high levels of *Stachybotrys*, for example, are toxic to virtually all individuals, others claim that the science does not support this finding.[25]

Allergic reactions are believed to be the most common exposure reaction to molds. All molds studied to date have the potential to cause biological reaction in susceptible (allergic) humans. These reactions range from mild, transitory responses, like runny eyes, runny nose, throat irritation, coughing and sneezing, to severe chronic illnesses such as sinusitis and asthma.[26]

The most cited study regarding the health effects of *Stachybotrys* following exposure to toxigenic fungi in water-damaged buildings was performed by Eckhardt Johanning, M.D., in 1996. Finding that intensity and duration of exposure were related to illness, the study concluded that "prolonged and intense exposure to toxigenic *Stachybotrys* and other atypical fungi was associated with reported disorders of the respiratory and central nervous system, reported disorders of the mucous membranes and a few parameters of the cellular and humoral immune system, suggesting a possible immune competency dysfunction."[27]

A recent report by the National Academy of Sciences determined that there was sufficient evidence to show an association between mold exposure and the aggravation of asthma in individuals who are sensitized to the disease. However, the report finds inadequate or insufficient evidence to determine whether or not an association exists regarding mold

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[24]Robertson, *supra* note 11, at 27.

[25]David M. Governo and Steven F. Goselin, *Avoiding And Minimizing Mold Liability: Understanding The Dynamics of Mold And Its Remediation*, Mealey's Lit. Rep.: Mold, Vol. 1, Iss. 4 (4/01) at 27.

[26]Harriet Ammann, Is Indoor Mold Contamination a Threat? Washington State Department of Health (visited May 17, 2001) <http://www.doh.wa.gov/ehp/oehas/mold.html>.

[27]Johanning, E.; Biagini, R.; Hull, D.L.; Morey, P.; Jarvis, B.; Landbergis, P. 1996. Health and immunology study following exposure to toxigenic fungi (*Stachybotrys chartarum*) in a water-damaged office environment. Int. Arch. Environ. Health. 68: 207-218.

exposure and the development of asthma.[28]

IV. DETECTING MOLD - ASSESSMENT AND REMEDIATION

An important resource for property owners/managers is the EPA guidance "Mold Remediation in Schools and Commercial Buildings."[29] The publication covers prevention of mold growth as well as a compilation of best practice procedures used for remediation.

Additionally, guidelines to assess and remediate indoor fungal contamination have been established by an expert panel convened by the New York City Department of Health (NYCDOH) that included representatives of the Mount Sinai Medical Center, Department of Occupational and Environmental Medicine, NY, and the American Industrial Hygiene Association (AIHA).[30] The NYCDOH Guidelines have been used in mold remediation cases throughout the country. The NYCDOH Guidelines (last revised in April 2000) are based on research results, empirical data, and the then best available professional judgments.[31]

For further resources: the California Department of Health Services (CDHS) provides a concise four-page fact sheet on how to remove mold growth and prevent it from returning;[32] the Minnesota Department of Health (MDH) provides a detailed guidance addressing everything from the health affects of mold to mitigation and prevention;[33] and CDC has published a question and answer document regarding *Stachybotrys* and other molds.[34] Several environmental consultants also recommend following the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control," for

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[28]National Academy of Sciences, Committee on the Assessment of Asthma and Indoor Air. *Clearing the Air: Asthma and indoor Air exposures*, (Washington, D.C.: National Academy Press, 2000) (visited May 17, 2001) <http://books.nap.edu/catalog/9610.html>.

[29]EPA, (March 2001) <http://www.epa.gov/iaq/molds/index.html>.

[30]NYCDOH, *supra* note 16.

[31]Eckardt Johanning, MD, *The Enviro Village Library Papers, Hazardous Molds in Homes and Offices: Stachybotrys atra and Others..., Assessment and Remediation* (visited Dec. 11, 2000) <http://www.envirovillage.com/Papers/N0000100008.htm>.

[32]CDHS, *supra* note 20.

[33]MDH, *supra* note 21.

[34]CDC, *Questions and Answers on Stachybotrys chartarum and other mold*s (Mar. 9, 2000) <http://www.cdc.gov/nceh/asthma/factsheets/molds/default.htm>.

assessment and remediation of mold growth.[35]

A. When should a building be tested for mold?

If mold can be seen or smelled, a mold problem exists and it is unnecessary to conduct microbiological testing to identify the mold. According to both NYCDOH and MDH, in most cases, microbiological sample testing a residence for mold is not recommended as the first step in determining if there is a mold problem. Testing residences for mold, in most instances, is costly and usually produces results that have very little, if any, practical value. At worst, test results can be misleading. There are a number of inherent limitations to mold testing. Testing is only warranted when there is a clear objective that can only be met through obtaining sampling data. There should be a clear understanding of what specifically is to be tested for and what the results will be used for before testing is even considered. A thorough visual inspection for mold growth or signs of water damage and wetness as well as locating sources of mold odors by smell, are more reliable and cost effective methods for identifying environments needing intervention.

B. Hiring a trained professional

If it is decided that microbiological testing is necessary, it is wise to retain a qualified environmental consultant to conduct an evaluation in which samples (potentially contaminated materials and air) will be collected to assess the nature and extent of the contamination (if any). It is recommended that such measures be carried out by an experienced and trained professional with demonstrated experience in mold remediation. Environmental consultants, including certified industrial hygienists (CIHs), should be selected with care.[36] For example, consider whether the consultant: carries liability insurance; has experience in successfully addressing mold contamination situations; and is affiliated with accredited laboratories.[37] Any contract/agreement a property owner/manager enters into should say that work should be performed in accordance with OSHA-mandated safety programs; expect to receive a written site-specific scope of work and work plan (worker protection, containment strategies, precise procedure and its sequence, disposal, estimated time-frame, number of technicians and

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[35]American Conference of Governmental Industrial Hygienists (ACGIH), *Bioaerosols: Assessment and Control* (Janet Macher, ed., 1998). (The document may be ordered on-line at http://www.acgih.org/catalog/pubshow1.asp?prod =3180).

[36]The AIHA maintains a listing of all CIHs and their areas of expertise. View AIHA online at www.aiha.org. You may also check with your local health department for a list of local industrial hygienists.

[37]The AIHA offers accreditation to microbial laboratories through the Environmental Microbiology Laboratory Accreditation Program (EMLAP).

supervisors and their qualifications etc.) for the project.[38]

Prior to hiring a mold remediation specialist, it may be useful to obtain a sample copy of a redacted report that was prepared by that individual for another property. The report should: be clearly written; be understandable to a layperson; reach conclusions; and make recommendations.

C. Property inspection

The presence of mold, water damage, or musty odors should be addressed immediately. In the case of a presumed mold contamination, a detailed visual inspection of the following areas should be conducted by trained personnel:

- the basement and lower floor rooms, crawl-spaces;
- any rooms that have experienced water and/or flooding damage;
- window frames and carpets, including carpet backing in water-stained areas (if possible);
- ceiling tiles or any formerly damp material made of fibrous cellulose (wallpaper, books, papers, cellulose-based insulation);
- all heating, ventilation, and air conditioning components;
- indoor spaces with exposed soil such as unfinished basements or crawl-spaces;
- greenhouses and water features (e.g., decorative fountains);
- attics with resident or seasonal birds, bats, or other animals; and
- other areas where excess moisture may be present (e.g., sauna areas, pools, spas, bathrooms).[39]

The use of equipment, such as a boroscope, to view spaces in ductwork or behind walls, or a moisture meter to detect moisture in building materials, may be helpful in identifying hidden sources of fungal growth and the extent of water damage.[40] Moisture meters may be useful in both the assessment and remediation stages of mold contamination to measure the amount

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[38]Governo & Goselin, *supra* note 23, at 28-29.

[39]Johanning, *supra* note 29.

[40]NYCDOH, *supra* note 16.

of moisture content in a variety of building materials following water damage or to monitor the process of drying damaged buildings. Some meters have a thin probe which can be inserted into the material to be tested while others can be pressed directly against the surface of the material.

D. Sampling

Through visual inspection and testing, the environmental consultant will identify the building components where mold is growing as well as materials and furnishings in which mold spores have deposited and which will become a reservoir for future mold contamination of the property. Samples of affected materials (e.g., insulation, wallboard, and carpet) may be collected and submitted to a laboratory to confirm the presence of mold and identify the species of mold present.

Bulk/surface sampling

According to both the NYCDOH Guidelines and EPA, bulk or surface sampling of building materials is not a prerequisite to undertake a remediation. Remediation of visible mold contamination should proceed without further evaluation. However, bulk or surface samples may need to be collected; (1) to identify specific mold contaminants as part of a medical evaluation if occupants are experiencing symptoms which may be related to mold exposure; or (2) to identify the presence of mold if a visual inspection is equivocal (e.g., discoloration and staining).

If it is decided that sampling be done, an individual trained in appropriate sampling methodology should perform bulk or surface sampling. Bulk samples are usually collected from visibly moldy surfaces by removing materials with a clean tool directly into a clean plastic bag. Surface samples are usually collected by wiping a measured area with a sterile swab or by stripping the suspect surface with clear tape. Surface sampling is less destructive than bulk sampling. Other sampling methods may also be available. A laboratory specializing in mycology should be consulted for specific sampling and delivery instructions.

Air monitoring

According to both the NYCDOH Guidelines and EPA, air sampling for mold should not be part of a routine assessment since decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some molds are prone to false negative results and therefore cannot be used to definitively rule out contamination.

Air sampling can test for the presence of mycotoxins, VOCs, mold spores, and fungal fragments (small pieces of the cell wall of molds). If air monitoring is performed, outdoor air samples should also be collected concurrently at an air intake, if possible, and at a location representative of outdoor air. For additional information on air sampling, refer to the American

Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."[41]

Air monitoring may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with mold exposure. Air monitoring may also be necessary if there is evidence from a visual inspection or bulk sampling that ventilation systems may be contaminated. The purpose of such air monitoring is to assess the location and/or extent of contamination throughout a building.[42] It is preferable to conduct sampling while ventilation systems are operating. If the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling, (e.g., mold growth behind walls) air monitoring may be necessary.

Personnel conducting the sampling must be trained in proper air sampling methods for microbial contaminants. A laboratory specializing in mycology should be consulted for specific sampling and shipping instructions. The analysis of samples in the laboratory generally requires a two-week incubation and analysis period. Although some recent technical advances may shorten this time-frame.[43]

Identifying the type of mold

According to MDH, if significant mold growth is observed, the precise species of mold does not matter in terms of what needs to be done.

If testing for mold is performed, it is critical to know the specific types of mold in order to interpret the sampling results. For example, you must determine if the species of molds found in the indoor air samples differ from those that are normally entering the building from the outdoors. If the molds found indoors are different from those in an outdoor sample, this suggests indoor mold growth is occurring. However, in most cases there is no need to identify the types of mold present because all indoor mold growth represents a potential hazard

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[41]ACGIH, *supra* note 33.

[42]AIHA, *Field Guide for the Determination of Biological Contaminants in Environmental Sampling*, 1996. ("A comparison of biodiversity between indoor and outdoor air samples (taken at the air intake) is a reliable determinant of the existence of the growth of fungi in a building or growth near the HVAC air intake. The *significant* presence of fungi in indoor air not present or as a minor component of the outdoor air mycoflora is taken as unacceptable from a health and performance point of view." (emphasis added)).

[43]EPA, *EPA Scientists Develop Technology for Detection of Dangerous Molds*, EPA Press Release (May 8, 2001). <http://yosemite.epa.gov/opa/admpress.nsf/b1ab9f485b098972852562e7004dc686/e6f7606ebe231f6b85256a4600699976?OpenDocument>.

(regardless of the type) and the solutions are the same for any mold. Thus, according to MDH, "since correcting the cause of mold growth and removing contaminated materials are the only practical actions needed, it is recommended that testing for mold not be done in most cases."

E. Testing costs

The estimates for an initial consultation and assessment vary widely depending on the nature and extent of the problem.[44] The time involved in the initial evaluation depends on the size of the property and the number of observations which require sampling. Lab fees associated with the identification of the organism and the scope of the contamination may be substantial. The initial assessment may well be the most important part of the remediation process since these findings dictate the specific intervention.

F. Property restoration clean-up procedures

The measures taken to initiate the clean-up process are dependent on the extent of the problem. The EPA has prepared a useful "Checklist For Mold Remediation" which may be accessed at www.epa.gov/iaq/molds/index.html.

According to CDC, mold can be cleaned off surfaces with a weak bleach solution. In areas where flooding has occurred, prompt cleaning of walls and other flood-damaged items with water mixed with chlorine bleach, diluted 10 parts water to one part bleach, is necessary to kill the mold. CDC cautions that bleach should never be mixed with ammonia.

Generally, the guidelines established by NYCDOH will guide you through the "remediation" process.[45] In many situations, the environmental consultant will specify procedures to be followed to ensure that the mold growth and contamination are removed without endangering residents or workers.[46] According to the NYCDOH Guidelines, general recommendations include (but are not limited to) the following steps:

- Eliminate or correct the water problems that caused the mold growth, such as water leaks or an improperly cycling HVAC system. Carpets, rugs, furniture, and any other items with absorbent material must be removed and discarded if not thoroughly dried within 24 hours of the onset of the moisture problem. Materials that remain wet for longer periods are unlikely to be able to be restored. Maintain relative humidity below 60 percent.

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[44]Hourly rates for industrial hygienists range from $90 to $200; there are additional charges for sampling and laboratory analyses.

[45]NYCDOH, *supra* note 16.

[46]Id.

- Stained ceiling tiles, carpet or wall board should be completely replaced, along with associated insulation materials. All debris should be removed from the area including corners, edges of the floors, and under and around fixtures. Use a high efficiency particulate air (HEPA) vacuum to remove and control dust.

- Caution should be taken around electrical equipment and fixtures. During all clean-up activities, a tight-fitting dust mask and eye protection should be worn by personnel conducting the clean-up. Rubber or vinyl gloves and waterproof boots should also be worn during all phases of the clean-up. Open all windows for drying and ventilation.[47]

- EPA recommends that HEPA vacuums be used in the final clean-up of remediated areas once the materials have been thoroughly dried, and the contaminated materials removed. The HEPA vacuums should also be used to clean-up dust that may have settled outside the remediation area.

If air ducts are required to be cleaned as part of the remediation plan, the EPA publication "Should You Have the Air Ducts in Your Home Cleaned?"[48] is a useful resource.

The chart below serves as a quick reference guide for various levels of mold contamination.[49] For the complete guidelines, refer to http://www.ci.nyc.ny.us /html/doh/html/epi/moldrpt1.html#exec.

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[47]Id.

[48]EPA, *Should You Have the Air Ducts in Your Home Cleaned?*, EPA-402-K-97-002 (Oct.1997). (The EPA publication may be accessed at, http://www.epa.gov/iaq/pubs/airduct. html).

[49]This summary of the NYCDOH Guidelines is provided by Aerotech Laboratories, Inc., an independent indoor air quality analytical laboratory located in Phoenix, AZ.

Remediation Parameter	Level 1	Level 2	Level 3	Level 4	Level 5A	Level 5B
Description	Small Isolated Areas (10 sq. ft. or less)	Mid-Sized Isolated Areas (10-30 sq. ft.)	Large Isolated Areas (30-100 sq. ft.)	Extensive Contamination (Greater than 100 contiguous sq. ft.)	HVAC Systems (Less than 10 sq. ft.)	HVAC Systems (Greater than 10 sq. ft.)
Examples	Ceiling Tiles, Small Areas on Wall	Individual Wallboard Panels	Several Wallboard Panels	Multiple Wallboard Panels		
Minimum requirements for remediation oversight^	Trained Building Staff	Trained Building Staff	Qualified Health and Safety Professional	Qualified Health and Safety Professional	Trained Building Staff	Qualified Health and Safety Professional
Respiratory ProtectionŽ	N95 Disposable respirator	N95 Disposable respirator	N95 Disposable respirator	Full-face respirators with HEPA cartridges	N95 Disposable respirator	Full-face respirators with HEPA cartridges
Gloves	Yes	Yes	Yes	Yes	Yes	Yes
Eye Protection	Yes	Yes	Yes	Yes	Yes	Yes
Protective Clothing	No	No	No	Yes	No	Yes
Remediation while unoccupied	Yes	Yes	Yes	Yes	Yes	Yes
Vacation of adjacent spaces	Recommended if occupied by susceptible groups*	Recommended if occupied by susceptible groups*	Yes	Recommended if occupied by susceptible groups*	Recommended if occupied by susceptible groups*	Recommended if occupied by susceptible groups*
Containment Required	No (However, several environmental consultants recommend using appropriate containment for any sizeable intervention.)	Critical barriers	Critical barriers	Critical barriers, airlocks, decontamination room within critical barriers	Critical barriers	Critical barriers, airlocks, decontamination room over 30 sq. ft.
HEPA Filtered Negative Air	No	No	No	Yes	No	Yes
Dust suppression	Misting	Misting	Misting	Misting	Misting	Misting
Bag contaminated materials	Yes	Yes	Yes	Yes	Yes	Yes
Post Remediation Cleaning of work area and egress	Clean with damp cloth and/or mop with detergent solution	HEPA vacuum and clean with damp cloth and/or mop with detergent solution	HEPA vacuum and clean with damp cloth and/or mop with detergent solution	HEPA vacuum and clean with damp cloth and/or mop with detergent solution	HEPA vacuum and clean with damp cloth and/or mop with detergent solution	HEPA vacuum and clean with damp cloth and/or mop with detergent solution
Clearance Testing	No	No	No	Yes	No	Yes

*Susceptible groups include infants less than 12 months old, persons recovering from recent surgery, immune suppressed people or people with chronic inflammatory lung disease (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

^OSHA Hazard Communication Standard 29 CFR 1910.1200, governs worker training. Such persons should receive training on proper clean-up methods, personal protection, and potential health hazards. A copy of the standard is available on the OSHA website at http://www.osha-slc.gov/ OshStd_data /1910_1200.html.

ŽRespiratory protection in accordance with the OSHA respiratory protection standard (29 CFR 1910.134) is recommended. A copy of the standard is available on the OSHA Web site at http://www.osha-slc.gov/OshStd_data/1910_0134.html.

G. Flood restoration and decontamination[50]

The most significant event that leads to building-wide water damage and, subsequently, environmental hazards associated with extensive microbiological contamination, is some type of flooding episode (e.g., heavy rain or a broken water line). Fortunately, proper techniques following a event can eliminate or significantly reduce microbial damage. Rapid response is critical. A restoration or remediation company should be on site within 8 hours of a flooding episode. The restoration company must also have the proper equipment to perform the task quickly and efficiently, including water extraction and dehumidification equipment. At a

[50]See Aerotech Laboratories Inc., *IAQ Remediation* (last viewed Jan. 4, 2001) <http://www.aerotechlabs.com/Library/iaqremed.htm>.

minimum the restoration company should:

- remove carpet and pad;
- remove cove moldings or other moldings if water has entered wall cavity;
- drill holes in wallboard to facilitate drying inside wall cavity;
- pay special attention to built-in cabinets, remove kick plates or drill holes; and
- have special equipment for remediation of microbiological contamination, if necessary.

If the damage is by anything other than clean water (potable water), special precautions must be taken. In sewage situations, pathogenic bacteria and viruses must be dealt with by evacuation of occupants until clean-up and disinfection has been completed. Workers entering the contaminated area must wear protective clothing and respirators.

If clean-up and drying is not accomplished expedicously, microbiological contamination is a concern. Clean water floods that are not dried out rapidly will require extensive demolition and removal of porous materials. Every situation is unique, but as a general rule, remediation personnel should:

- equip remediation workers with protective equipment;
- contain the area in need of remediation;
- exercise extreme care when removing contaminated materials and bag them before removing them from the contaminated area;
- remove contaminated or d porous organic materials and discard (e.g., drywall, ceiling material, insulation, flooring, carpet, pad, sub floor material, and cabinets with particle board bases); and
- remove spores and other fungal particulates from the air and from surfaces using HEPA filters and vacuums.
    - Use negative air containment to protect other parts of the structure during demolition; and
    - Use HEPA filters to clear the air after demolition.

H. How do you know when a remediation/clean-up is complete?

According to the EPA, remediation has been completed if:

- the water or moisture problem has been fixed completely;

- the mold has been completely removed. Professional judgment and common sense should be used to determine if the clean-up is sufficient. Visible mold, mold-damaged materials, and moldy odors should not be present;

- the kinds and concentrations of mold and mold spores in the building are similar to those found outside, once clean-up activities have been completed;

- upon revisiting the sites where mold contamination was present, shortly after remediation, no signs of water damage or mold growth are present; and

- people occupy or re-occupy the space without health complaints or physical symptoms.

Ultimately, according to EPA, this is a judgment call; there is no easy answer.

I. Remediation costs

Remediation costs vary greatly depending on the nature and extent of the problem and can cost from a few hundred dollars for small, isolated areas of mold infestation to millions of dollars for contamination that is widespread throughout a building and may have compromised the structural integrity of the building. In some cases, there will be expenses associated with resident relocation while mold remediation work is in process. Some single family homes have been found to be uninhabitable and have been declared a total loss because the extensive mold infestation could not be cost-effectively remediated.

V. Correcting Conditions Which Favor Mold Growth

Controlling moisture is the key to preventing indoor mold growth. Rapid response to moisture problems is often critical. To control indoor moisture, MDH recommends: "fixing plumbing leaks, drips or "sweating" pipes; limiting sources of indoor humidity/dehumidifying indoor air; improving air movement in poorly ventilated areas; increasing fresh air ventilation when outdoor air is not humid; and warming cold surfaces where condensation occurs. To control outdoor moisture: maintain roof and gutter/downspout systems; direct runoff away from foundation by grading, draintile, landscaping, etc.; use air conditioning and keep building closed during high outdoor humidity; prevent leakage around windows, doors, flashing, etc.; and waterproof foundation structure."

A. Air conditioners

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), a voluntary standard setting organization, addresses the importance of avoiding the use of over-sized air conditioners (and to maintain the air pressure in the house at either neutral or

positive pressure).[51] An over-sized air conditioner will not run long enough to remove the latent heat (the moisture) in the air, which results in cold, clammy air. By maintaining a positive or neutral air pressure in the house, dry conditioned air is being pushed into the wall rather than humid air being pulled in from outside.

The EPA guidance "Building Air Quality, A Guide for Building Owners and Facility Managers"[52] sets forth the following suggestions:

B. Exterior corners

The interior surfaces of exterior corners are common locations for mold growth. They tend to be closer to the outdoor temperature than other parts of the building surface for one or more of the following reasons: poor indoor air circulation in the interior; wind-washing (i.e., the wind on a building which can cause a much lower temperature on the window surface than the rest of the indoor temperature); low insulation levels; and/or greater surface area of heat loss. Sometimes mold growth can be reduced by removing obstructions to airflow (e.g., rearranging furniture). Other factors being equal, buildings with forced air heating systems and/or room ceiling fans tend to have fewer mold problems than buildings with less air movement.

C. Temperature

A temperature range from 40° to 100° F is optimal for mold growth. "Set back" thermostats are commonly used to reduce energy consumption during the heating season. Mold growth can occur when temperatures are lowered in buildings with high relative humidity. The amount of moisture in the room can be estimated by measuring both temperature and relative humidity (RH). If the RH is low (e.g., 30%), it is probably due to room surfaces that are "too cold." Temperature is the dominating factor, and control strategies should involve increasing the temperature at cold room surfaces. If the RH is high (e.g., 50%), it is probably because the air is "too moist." Humidity is the dominating factor and control strategies should involve decreasing the moisture content of the indoor air. Mold problems can also be as extensive in areas in which air treatments primarily involve cooling. The same principles apply: either surfaces are too cold, moisture levels are too high, or both.

> "One common example of mold growth in cooling climates can be found in rooms where conditioned "cold" air blows against the interior surface of an exterior wall. This condition, which may be due to poor duct design, diffuser location, or diffuser performance, creates a cold spot at the interior finish surfaces,

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[51]ASHRAE, *1997 ASHRAE Fundamentals Handbook*, Chapter 22, Thermal and Moisture Control in Insulated Assemblies - Fundamentals, 1997.

[52]EPA, *supra* note 10, at 145.

> allowing moisture to condense. Mold problems can also occur within the wall cavity as outdoor air comes in contact with the cavity side of the cooled interior surface. It is a particular problem in rooms decorated with low maintenance interior finishes (e.g., impermeable wall coverings such as vinyl wallpaper) which can trap moisture between the interior finish and the gypsum board. Mold growth can be rampant when these interior finishes are coupled with cold spots and exterior moisture."

Solutions include:

- eliminating the cold spots (i.e., elevating the temperature of the surface) by relocating ducts and diffusers;

- increasing the room temperature to avoid overcooling; and

- preventing the hot, humid exterior air from contacting the cold interior finish by ensuring that vapor barriers, facing sealants, and insulation are properly specified, installed, and maintained.

According to ASHRAE, the proper placement of vapor barriers (vapor retardants) in particular climates remains uncertain in the industry. It is undisputed that kraft-faced vapor retardants, for most areas, should be installed toward the interior of the wall. For warm, humid climates however, the ASHRAE standards state that "the use of vapor retarders is not required in humid climates (typically southern Florida and the Gulf coast). If vapor retarders are used, they should be on the exterior (of the wall)." In these humid climates, wall assemblies must be protected from moisture from the exterior and allowed to dry towards the interior. A humid climate is defined by ASHRAE as "one in which one or both of the following conditions occur: A 67° F or higher wet-bulb temperature for 3500 hours or more during warmest six consecutive months of the year; and/or a 73° F or higher wet-bulb temperature for 1750 hours or more during warmest six consecutive months of the year."[53]

The uncertainty of where to place the vapor barrier arises in warm, mixed climates. Little research has been done by the industry on the issue. Industry practices, as well as local building codes, have conflicting specifications. According to ASHRAE, depending on local experiences with moisture problems, a humid-climate design criteria may also be desirable in locations that do not quite meet the conditions described above. Fringe areas include some locations in the southeastern United States (notably AL, AK, GA, LA, MS, NC, SC, and east TX). Fringe locations are generally identified by one or both of the following conditions: A 67° F or higher wet-bulb temperature for 3000 hours or more during warmest six

[53]ASHRAE, "Energy-Efficient Design of New Low-Rise Residential Buildings," Section 5.7 ASHRAE Standard 90.2-1993.

consecutive months of the year; and/or a 73° F or higher wet-bulb temperature for 1500 hours or more during warmest six consecutive months of the year.[54]

D. Windows

In winter, windows are typically the coldest surfaces in a room and have water condensate on the interior surfaces.

Condensation on window surfaces has historically been controlled by using storm windows or "insulated glass" (e.g., double-glazed windows or selective surface gas-filled windows) to raise interior surface temperatures. The advent of higher performance glazing systems has led to a greater incidence of moisture problems in building enclosures because buildings can now be operated at higher interior vapor pressures (moisture levels) without visible surface condensation on windows.

E. Concealed condensation

While the use of thermal insulation in wall cavities to increase interior surface temperatures in heating climates may reduce the likelihood of interior surface mold, mildew and condensation, without a properly installed moisture barrier, moisture condensation within the wall cavity may actually increase. The first condensing surface in a wall cavity in a heating climate is typically the inner surface of the exterior sheathing.

Concealed condensation can be controlled by the following strategies:

- reducing the entry of moisture into the wall cavities (e.g., by controlling the pass through of moisture-laden air);
- elevating the temperature of the first condensing surface:
    - in heating climate locations: installing exterior insulation (assuming that no significant wind-washing is occurring); and
    - in cooling climate locations: installing insulating sheathing to the interior of the wall framing and between the wall framing and the interior gypsum board.

[54] Id.

VI. PROTECTING YOURSELF BEFORE MOLD INFESTATION ISSUES ARISE

A. Due diligence

Indoor pollution liability is an issue that should be assessed in any real-estate transaction. In the purchase of an already constructed building, investigations for potential IAQ problems should be included as part of the general environmental due diligence review. A building inspection procedure should include a background assessment of the building, interviews of persons responsible for mechanical systems and facility maintenance, inspection of the HVAC system and measurement of the concentration levels of volatile organic compounds, and inspection for the presence of specific microbiological (i.e., mold) and other contaminants, including asbestos and radon.[55]

B. Protect your building from mold and yourself from liability

Building owners and managers should take appropriate steps now to reduce the prospect of indoor air pollution claims.

(1) Establishment of an environmental management system

According to attorneys Kenneth Warren and Neil Witkes,[56] an environmental management system should be established and should include several components:

a. Corporate policy

In contrast to the command and control structure of many of our environmental laws, the standards applicable to indoor air are far less developed. According to the EPA guidance, standards or threshold limit values for airborne concentrations of mold or mold spores have not yet been set. *As of December 2000, there are no federal regulations or standards for airborne mold contaminants in the residential environment.* Thus, apart from the specific regulatory restrictions on the concentrations of radon in the residential environment, no regulatory standards for indoor air exist. Air levels of asbestos and lead, for example, are only regulated in the context of activities which disturb surfaces containing these substances. There are currently no federal laws that govern mold infestation. However, local laws on habitability

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[55]Cynthia Weiss Antonucci, *Indoor Air Pollution, Sick Building Syndrome/Building Related Illness An Overview*, Mealey's Sick Building Litigation Conference, 303, 309 (West Palm Beach, FL, Nov. 8-9, 1999).

[56]*Avoiding Indoor Air Quality Claims: Advice for Building Owners*, IEQ Strategies-Managing Risk in the Indoor Environment: A Practical Handbook, 26, 27-29 (Carlton Vogt ed., Cutter Information Corp., 1998).

may apply.

In most localities, building owners are "only" required to comply with what a jury, with the benefit of hindsight, will find to be reasonable. At a minimum, a building owner or manager should identify and comply with any applicable regulations under local and state law as well as the ASHRAE standards[57] (e.g., HVAC operation should meet air exchange rates specified in the current ASHRAE standard[58]). The operations and maintenance (O & M) plan for a building should address IAQ. Maintenance personnel should be informed of proper air exchange settings and maintenance schedule of HVAC, and have sufficient funds available for compliance.

b. Proper maintenance procedures

Maintenance procedures may be established by the property owner/manager which can minimize, if not eliminate, IAQ problems. These include:

- having the building inspected regularly by an environmental professional so that potential problems may be discovered and corrected before they become widespread;
- using appropriate HVAC settings per the manufacturer recommendations, even when the building is not occupied;
- changing or cleaning air filters (according to the manufacturer's recommended schedule);
- cleaning air conditioning coils according to the manufacturer's recommended schedule or at least annually;
- eliminating sources of air pollution (e.g., garbage receptacles, idling cars or loading docks) from air intake equipment; and
- developing maintenance guidelines based on manufacturer's specifications and incorporating these into the O & M plan for the property.[59]

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[57]Id at 29.

[58]ASHRAE 62-1989, Ventilation for Acceptable IAQ, provides a minimum of 15 cubic feet per meter (cfm) of outdoor air per person and 20 cfm in office spaces. Up to 60 cfm/person may be required in some spaces (such as smoking lounges) depending on the activities that normally occur in that space. Revisions to this standard, which would require the multifamily property owner to install kitchen exhaust fans and continuously running fans in bathrooms, are expected in the next 2-3 years.

[59]Antonucci, *supra* note 53, at 309-310.

c. Identification and correction of IAQ problems

The building O & M plan should address how potential IAQ problems will be identified, corrected, and how information will be conveyed to residents. It is prudent to keep a record of all IAQ complaints received from residents and the steps taken to address the problems. EPA suggests that an "IAQ Complaint Form" be filled out by the property staff handling the complaint,[60] as well as an "Incident Log" to keep track of each response.[61] (See Attachments A and B.)

d. Training of employees to operate the building according to the established procedures

Employees should receive appropriate training to maintain the building and its systems. Personnel should have clearly defined responsibilities and delineated reporting obligations, and receive performance evaluations that are based at least, in part, on compliance with these identified standards and procedures.[62]

e. Notification by resident to property owner/manager

Specific language should be included in the lease which advises residents to notify the property owner/manager if water intrusion exists (e.g., leaking faucets, deteriorated ceiling tiles) or if mold growth is noted on surfaces (e.g., floors and walls).

(2) Guidance for maintenance technicians

According to Patrick Connor, President of Connor Environmental Consulting Services and Engineering Assessments in Baltimore, maintenance professionals should be alerted to the presence of mold if they should come across it during routine repair and use appropriate practices to limit human exposure and the possible spread of the contamination. The maintenance professional should evaluate the extent of the mold problem. If it is a small discrete area, it may be treated as described above in Section IV. E. If the mold is associated with a larger problem such as substantial water damage, structural damage is possible and will require a more involved treatment. If the mold has contaminated a large area, maintenance workers should not disturb the contaminated area as it can create even bigger

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[60]EPA, *Building Air Quality, A Guide for Building Owners and Facility Managers, Indoor Air Quality Forms,* 171, 181, EPA/400/1-91/033 (Dec. 1991). (Attachment A)

[61]Id. at 183. (Attachment B)

[62]Warren & Witkes, *supra* note 54, at 28.

clean-up challenges and may pose a threat to unprotected workers. In such a situation, the maintenance staff should cease work in the area and report to a supervisor or property manager. A qualified environmental specialist, such as an industrial hygienist, should be retained to assess the problem and develop a plan of remediation.

(3) Insurance coverage

The best time to review your insurance coverage is before a situation develops which may result in a claim. Whether or not a mold claim is covered by a standard form general liability policy depends upon both the jurisdiction and the specific policy. Generally, in cases where the water damage is covered by the insurance policy, the resultant damage, mold, will also be covered and thus insurers are willing to cover the cost associated with remediation of the mold damage. However, in recent years, the "absolute pollution exclusion" that began appearing in general liability policies in the mid-1980s, has been used by some carriers to deny claims resulting from mold damage.[63] The insurance industry has begun to specifically exclude mold from coverage in comprehensive general liability (CGL) policies. The exclusion, which began appearing in CGL in 1997 and 1998, is now included in many CGL policies covering multifamily properties. It is essential to review a copy of your present CLG policy, before a problem arises, to see if this mold exclusion exists.

Despite the insurer's insistence that the "absolute pollution exclusion" covers mold claims, courts are split on whether the exclusion bars coverage. The case holdings tend to be fact specific, with different outcomes arising out of only slightly different sets of facts. There are few cases that have been litigated on the issue of whether the "pollution exclusion" bars coverage for mold infestation. The case holdings have varied from state to state.

The Wisconsin Court of Appeals held that the "absolute pollution exclusion" clause did bar coverage. In this case, occupants of a prefabricated home brought action against the insurer, alleging their homes retain excessive moisture on their exterior walls, promoting mold, fungus, and other toxins.[64] The court concluded, because the growth of the microorganisms was the result of water vapor trapped in the wall, the contaminants were not released within the meaning of the policy, "but rather formed over time as a result of environmental conditions."

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[63]The customary pollution exclusion provides that the insurance does not apply to "bodily injury or property damage arising out of the actual, alleged, or threatened discharge, dispersal, release, or escape of pollutants at or from premises you own, rent, or occupy." Pollutants are generally defined as "any soluble, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals and waste."

[64]*Leverence v. United States Fidelity & Guaranty*, 158 Wis.2d 64, 462 N.W.2d 218. (This determination however was secondary to the court's holding that the exclusion was inapplicable because the contaminants had not been released)

Similarly, in *Stillman v. Travelers Insurance Co.*[65] the court entered final summary judgment in favor of the insured, holding that the "absolute pollution exclusion" provision did not apply. In this case, employees of a Florida bank allegedly sustained injuries as a result of high levels of fungi, mold, and yeast found in the building following construction improvements on the building.

In *Stoney Run Co. v. Prudential-LMI Commercial Insurance Co.*,[66] the U.S. Court of Appeals for the Second Circuit, interpreting New York law, held that the release of carbon monoxide due to a faulty heating and ventilation system at an apartment community, and where bodily injury occurred, was not the type of environmental pollution contemplated by pollution exclusion clause. While the court never specifically addressed whether carbon monoxide was a "pollutant" as defined by the policy, the court held that the pollution exclusion should be interpreted in light of its general purpose to exclude coverage for environmental pollution. Since the exclusion was ambiguous and a reasonable policy holder may not consider this circumstance to be environmental pollution, the court found that coverage existed.

However, other courts have decided to the contrary. In one case, the New York Supreme Court case held that the underlying claims for bodily injury caused by SBS were within the scope of the exclusion and thus refused to limit the scope of the "absolute pollution exclusion."[67]

In *West American Insurance Company v. Band and Desenberg*, the building's employees claimed that air-borne contaminants in the building's air, which was spread throughout the building due to a poorly designed air conditioning system, caused them to suffer a series of symptoms collectively referred to as SBS. The court denied coverage by concluding the language of the pollution exclusion was unambiguous. "Under the clear language of the policy, there is no coverage for bodily injury due to a release or dispersal of contaminants...into the air supply of the building."

A court's decision may also vary depending on the exact language of the pollution exclusion provision in the insurance policy. Further, policies commonly include a provision that permits the carrier to disclaim coverage if the claimant fails to notify the carrier immediately after an IAQ claim arises. Thus, it is imperative that you notify your insurance carrier as soon as you

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[65]No. 92-1949-CIV (S.D.Fla.1992).

[66]47 F.3d 34 (2d Cir. 1995).

[67]*Advanced Healthcare Resources Inc. v. Merchants Insurance Co. of New Hampshire, Inc.*, No. 97-1677 (N.Y. Sup. Ct., Suffolk Cty. 1997).

become aware of an mold contamination claim.[68]

While the majority of cases have been brought against the insurance company for failure to provide coverage under the absolute pollution exclusion, suits alleging other causes of action, including fraud by the insurance company, have been successfully litigated. On June 2, 2001, in a case brought by a homeowner against the insurance company for failure to provide coverage, a Texas jury awarded $32.1 million to a Dripping Springs family for extensive mold damage to their home.[69] Ruling against the insurer, Farmers Insurance Exchange, the jury held that insurer failed to adequately cover repair costs for the original water-damage and committed fraud in the handling of the claim when it failed to cover repairs for a water leak. Failure to make the necessary repairs led to the growth of mold. Despite the judge's preliminary ruling that medical testimony on the health effects of mold could not be introduced because of a Texas Supreme Court decision mandating a level of scientific proof that had not been reached, the jury awarded the Texas family $6.2 million in actual damages, $12 million in punitive damages, $5 million for mental anguish and $8.9 million in lawyers' fees. The ruling to exclude medical testimony on the health affects of mold squashed the personal injury aspect of Ballard's claim. The personal injury claims alleged by the family are expected to be considered in future suits brought by Ballard.

Once a mold claim arises, an owner/manager should immediately contact the general liability carrier. Consideration should be given to submitting a claim to the general liability carrier who covered the building or project in question in years prior to making the claim, based on the presumption that the situation that resulted in the development of mold was likely to have existed at some prior point in time. For example, the California Supreme Court held that where a CGL policy is written as an "occurrence policy," a "potential for coverage" exists in environmental or construction defect claims from the date the loss could have occurred.[70] In this situation, it may mean when the mold first began to grow until the time of the filing of the claim. This ruling can be significant if it is found that the present policy contains a carved-out mold exclusion. Most policies written prior to 1998 do not have such an exclusion and thus a "potential for coverage" may exist under the prior policy.[71]

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[68]Mark Diamond Esq., *What to Do If You Get Sued: Minimizing Your Exposure*, IEQ Strategies "Managing Risk in the Indoor Environment: A Practical Handbook, 42, 46 (Carlton Vogt ed., Cutter Information Corp., 1998).

[69]*Mary Ballard, et al. v. Fire Insurance Exchange, et al.*, No. 99-05252 (Texas Dist., Travis Co. 2001).

[70]*Montrose Chemical Company v. Superior Court*, 6 Cal.4th 287 (1993).

[71]John C. Manly Esq., *Mold and Insurance Coverage: General Liability Policies May Not Cover Mold*, California Perspective Magazine, 40 (April 2001).

Since insurers will likely respond to these various court decisions by revising their general liability policies to exclude IAQ claims, it would be imprudent to continue to rely upon these policies if such coverage is desired. "Pollution buyback" policies specifically tailored to provide these types of coverage are available.[72]

As a further precaution, the property owner should also verify that contractors providing services on their property are appropriately insured. It may be prudent to have all vendor/contractors sign indemnity agreements and agree to list the property owner/manager as insured under their CGL insurance policy. This contractual agreement should specify that there are no mold exclusions in the policy.[73]

VII. ADDRESSING RESIDENT COMPLAINTS

If, despite all efforts aimed at prevention of mold contamination, a resident files a complaint with the property owner/manager alleging mold or other IAQ problems, a property owner/manager may still be able to avoid a lawsuit. All complaints do not necessarily turn into lawsuits if the property owner/manager responds appropriately. It is of the utmost importance to keep the lines of communication with the resident open when responding to the complaint. According to attorney Mark Diamond, it is also important to:

(1) mitigate the problem by eliminating or correcting the water or other problem that caused the mold growth, such as water leaks or an improperly cycling HVAC system;

(2) notify insurance carriers of any claim. It is common that a policy includes a provision that permits the carrier to disclaim coverage if the property owner fails to notify the carrier immediately after it becomes known;

(3) retain a qualified environmental consultant to conduct air quality measurements. (See Section IV.A. above for additional information.);

(4) contact and retain competent legal counsel early to assist in coordinating all professionals necessary to address the IAQ complaint; and

(5) gather all records that pertain to the particular apartment as well as the building maintenance procedures, prior complaints, and how and when the complaints were remedied.

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[72]A sample policy may be viewed at http://www.ins-site.com/roughnotes/isoforms/glforms/cg0039o3.htm.

[73]Manly, *supra* note 68, at 42.

A. Notification to other building residents

Mold contamination may be widespread as a result of mold products that have been disseminated throughout the property, or the contamination may be exclusive to a specific unit. Thus, it is advisable to discuss with the environmental consultant conducting the assessment if notification to other residents is necessary in light of the remediation steps underway. If it is agreed that notification to residents is recommended, you may wish to consult an attorney to devise the notification.

B. Relocation of residents

There may be some circumstances in which the relocation of residents during remediation may be necessary. According to the EPA guidance, the decision to relocate residents should be based on the size of the area affected, the extent and types of health effects exhibited by the residents, and the potential health risks associated with debris and activities during the remediation project.

VIII. LEGAL ISSUES

A. Causes of action

There are numerous potential causes of action available to a claimant filing an IAQ claim due to mold contamination. Each of these causes of action are generally explained below; however, note that there may be state by state variations in interpretations, as well as other elements, of each cause of action.

(1) Negligence

Negligence, a legal theory by which an injured party can seek monetary damages for injury suffered by the action or inaction another, is the most common cause of action asserted for mold contamination. This theory has four elements which a plaintiff must prove in court to prevail: (1) Duty. The person/entity causing the harm must have owed the injured party a duty; (2) Breach of that duty. That is, the person/entity causing the harm must have failed, by act or omission, to prevent injury to the plaintiff; (3) Proximate cause. The act or omission of the harm caused must have resulted in the injury claimed by plaintiff ; and (4) Injury. The plaintiff must have sustained some injury as a result of the duty and action or omission alleged.[74]

Regarding the first of the four elements, duty, in addition to any specific obligation contained in a lease, a property owner/manager owes a common law duty to building occupants to make

[74]William L. Prosser, the Law of Torts, 143 (4th ed. 1971), Restatement (Second) of Torts, sec. 281 (1991).

necessary repairs, take steps to ensure that the property is fit for human habitation, and ensure and maintain that the quality of air inside the building is reasonably safe for the residents and other lawful occupants.[75] Thus, because this is a very broad and ill-defined duty, it is often difficult for owners/managers to avoid the necessity of defending what may be marginal claims.[76] A plaintiff does not need to show that the defendant intended the injury. Similarly, it is typically of little value to defendants that they did not realize an injury would occur. A plaintiff must merely prove that a reasonable person in the defendant's position, using reasonable intelligence, could have foreseen that an injury would occur to someone at some time.[77] Hence, according to attorney Mark Diamond, although the ASHRAE Standard 62-1989 does not have the force of law, it would be prudent to adjust professional practices to incorporate that standard as well as other trade standards (e.g., NYCDOH Guidelines discussed in Section IV above), government regulations (e.g., OSHA's proposed IAQ rule, should it become law[78]), and opinions (see case law discussed below in Section VIII. F.). Reasonable compliance with these standards may constitute sufficient foresight to protect yourself from any negligence liability claims.[79]

(2) Strict liability

Strict liability, while often confused with negligence, is different. To prove strict liability, a plaintiff must show that a defendant: (1) engaged in an unusually dangerous activity; (2) designed or manufactured a product that is unsafe; or (3) failed to give an adequate warning of the dangers of a product and how to avoid attendant risks.[80] Strict liability imposes liability even though the defendant acted with due care and had no knowledge that a condition was dangerous, or even that it existed. Many parties may be vulnerable to strict liability; a builder who used unsafe materials and methods during construction; a lender who failed to warn purchasers about an unsafe condition; and an owner who allowed occupants to be exposed

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[75]Robertson, *supra* note 11, at 24.

[76]David M. Governo & Lisa A. Hack, Attys., *IAQ Problems: The More You Look, the More You Find!*, IEQ Strategies-Managing Risk in the Indoor Environment: A Practical Handbook, 36, 37 (Carlton Vogt ed., Cutter Information Corp., 1998).

[77]Diamond, *supra* note 66, at 44.

[78]U.S. Occupational Safety and Health Administration (OSHA), Indoor Air Quality, 59 Fed. Reg. 15968, 16039 (1994).

[79]Diamond, *supra* note 66, at 44.

[80]Id.

to an unsafe condition.[81]

(3) Breach of contract

In a breach of contract claim, the plaintiff, if an employee, may claim that the building owner or manager breached a collective bargaining agreement provision specifying the nature and duration of potential toxic exposures.[82] In a breach of lease/contract claim brought against an owner/manager, a plaintiff may allege that clauses in the lease state what can or cannot be introduced into the building environment.[83] Additionally, the resident may file an action stating that the IAQ problem has caused the resident to be unable to use the leased space as provided in the lease.[84]

(4) Breach of warranties

Implied warranties generally exist under the law even if the owner/manager makes no affirmative representation of them orally or in writing. Unlike expressed warranties, which can be freely disclaimed, most states do not permit the implied warranties of merchantability or habitability to be disclaimed. The implied warranty of merchantability states that a party who trades goods to another automatically represents that those goods are fit for the particular purpose for which they were sold or leased (e.g., when purchasing a pair of shoes the seller makes an implied warranty to the buyer that the shoes will be fit for walking). The implied warranty of habitability may require an owner/manager to provide safe premises to the lessee and other occupants. It will undoubtably be argued that leasing space which is determined to have poor IAQ could be construed as a breach of habitability.[85]

(5) Constructive eviction

In some states, when a property owner/manager breaches an implied covenant of habitability, or covenant of quiet use and enjoyment, a construction eviction may also occur. The owner/manager's breach of covenant may entitle the resident to recover monetary damages

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[81] Id.

[82] Governo & Hack, *supra* note 73, at 37.

[83] Id.

[84] Id at 38.

[85] *Call v. Prudential Insurance Co. of America,* No. SWC 80813 (Los Angeles County Super. Ct., Cal. Oct. 1990).

from the property owner for a constructive conviction.[86]

(6) Failure to disclose

Any person who sells or transfers title or has a posessary interest to residential real estate, owes a common law to disclose all facts that materially affect the value or desirability of the property.[87]

(7) Fraud and misrepresentation

Fraud and misrepresentation occur when a person is injured by another person's intentional, reckless, or negligent concealment of a material fact that is not readily observable. In some jurisdictions, giving a bad opinion, not just a statement of fact, to someone who relies upon that opinion and could not reasonably have discovered its falsity may be actionable.[88]

(8) Battery and assault

Battery and assault take place when one person who has not consented is touched or otherwise contacted by another person or thing. One commentator posits that exposing someone to volatile organic compounds, such as certain types of mold, might be construed as an assault or battery.[89]

(9) Trespass

Trespass is an improper physical interference with one's person or property that causes injury to health or property.[90]

(10) Nuisance

Nuisance is an invasion of one's use or enjoyment of property, even if the defendant is not physically present on the property.[91]

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[86]*See Barkett v. Brucato,* 264 P.2d 978 (Cal. Ct. App. 1953).

[87]Robertson, *supra* note 11, at 25.

[88]Diamond, *supra* note 66, at 45-46.

[89]Id at 46.

[90]Id.

[91]Id.

The list of potential causes of action is long and the potential damages are large. However, while the above is an exhaustive list of possible causes of action a resident may use to sue his property owners/manager; negligence, constructive eviction (breach of warranty of habitability), and breach of contract are most commonly used.

B. Potential defendants

There are often several defendants involved in a legal action arising from mold contamination. For both personal injury and property damage claims, residents may sue property owners, managers, and contractors. Architects, engineers, construction managers and supervisors, contractors, sub-contractors, and suppliers of the building's materials may all be implicated when the source of the problem proves to be a building's design or HVAC system.[92]

In turn, it is wise to involve other potentially liable parties with whom to share the ultimate costs, should this be necessary in the end. The owners may need to sue architects, engineers, contractors, sub-contractors, and building product suppliers and manufacturers for the cost of any needed repairs and renovations.[93]

C. Causation issues

Regardless of what legal theory is relied on in an IAQ lawsuit, causation will be the most difficult element to prove.[94] The question at issue being whether the defendant's breach of duty actually caused the claimed injury. It is difficult for a party to prove or disprove this causal connection. Under the general standards of the rules of evidence, medical expert testimony offering an opinion as to causation will only be admissible if the opinion is rendered "to a reasonable degree of medical or scientific certainty."[95] There are two tests courts typically apply to test for the admissibility of scientific expert testimony.

The case of *Daubert v. Merrell Dow Pharmaceuticals Inc*[96] established the test for admissibility of scientific expert testimony in the federal courts. To establish whether expert testimony constitutes scientific knowledge, the court will look to the following factors:

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[92]John C. Childs & Marc G. Whitehead, *Establishing Causation In a Sick Building Case: the Plaintiffs' Perspective,* Mealey's Sick Building Litigation Conference, 315, 320-321 (West Palm Beach, FL, Nov. 8-9, 1999).

[93]Id at 321.

[94]Governo & Hack, *supra* note 73, at 37.

[95]Id.

[96]509 U.S. 579 (1993).

- whether the theory has been subjected to peer review or publication;
- whether the theory can be or has been tested;
- whether there is a known, acceptable rate of error; and
- whether the theory is generally accepted.[97]

However, since most mold cases will be filed in state courts, the standard of admissibility which is generally applied was established in *People v. Kelly.*[98] It is important for counsel to determine which standard, *Daubert* or *Kelly/Frye*, is relied upon by the court considering the mold case. Often referred to as the "Kelly/Frye" standard, new scientific evidence is only admissible on a showing of scientific reliability demonstrated by substantial agreement and consensus in the scientific community. The factors the courts look to are:

- whether the new scientific method is shown to be reliable;
- whether the witness is qualified as an expert in the field; and
- whether the theory or method in question was implemented according to proper scientific procedures.[99]

Thus, the success of any mold contamination case will unquestionably depend on the admissibility and credibility of the expert witnesses. Experts may include mycologists, microbiologists, industrial hygienists, neuropsychologists, immunologists and toxicologists.[100]

Due to a recent holding by a Delaware state court[101], the federal standard for expert witnesses may now start to be applied in state court and it now may be more difficult for plaintiffs to sue under a SBS or multiple chemical sensitivity (MCS) cause of action. The plaintiffs in this case claimed to have contracted MCS and SBS from the defendant's building. The court granted the defendant's motion to exclude the plaintiff's expert testimony based upon precedent

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[97]Robertson, *supra* note 11, at 31.

[98]17 Cal.3d 24 (1976).

[99]Robertson, *supra* note 11, at 31.

[100]Robertson, *supra* note 11, at 30. Definitions: A mycologist specializes in the study of fungi; a microbiologist has a general background in the study of bacteria, viruses, and yeasts and may specialize in a particular area; an industrial hygienist studies technical safety work identifying, evaluating, and controlling occupational health and safety hazards; a neuropsychologist deals with the relationship between the nervous system, especially the brain, and cerebral or mental functions such as language, memory, and perception; an immunologist studies the processes and substances associated with the resistance of humans to infections and diseases; a toxicologist studies the toxic effect of chemicals.

[101]*Minner v. American Mortgage & Guaranty Co.*, 2000 WL 703607 (Del.Super.Ct. Apr. 17, 2000).

established in *Daubert* that scientific expert testimony must be "generally accepted" by the scientific community for it to be admissible. Here, the court agreed with the defendant that medical science does not recognize MCS or SBS and, as such, they cannot be validly diagnosed as medical conditions. The plaintiffs settled the case soon after the motion was granted. This decision will likely be cited and serve as precedent in subsequent IAQ mold contamination cases.

D. Alleged injuries

Lawsuits arising from mold and other indoor air pollution typically involve both personal injury and property damage components. Personal injuries caused by indoor air pollution generally fall into three categories: building related illnesses (BRI), MCS, and SBS.[102] Other illnesses such as Chronic Fatigue Syndrome (CFS), Fibromyalgia (FM), Reactive Airway Dysfunction Syndrome (RADS), Reactive Airway Initiated Dysfunction Syndrome (RAIDS), and Toxic Encephalopathy (TE) have also been cited by plaintiff residents as injuries caused by the building and thus the building owner/manager.

"SBS is used to describe situations in which the building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified."[103] It is acknowledged that there is no universally accepted clinical definition of SBS and no adequate theory for its occurrence.[104] Thus, because the medical community has not accepted SBS as a medically valid diagnosis, it does not meet the *Daubert* standard. Most courts have excluded the diagnosis.[105]

"BRI is used when symptoms of diagnosable illness are identified and can be attributed to airborne building contaminants."[106] It is still uncertain whether the scientific community and thus the courts recognize BRI. In a 1997 article published by the New England Journal of Medicine, researchers noted that there is little convincing, direct evidence to implicate specific

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[102]Robertson, *supra* note 11, at 23.

[103]EPA, *Indoor Air Facts No. 4 (revised)- Sick Building Syndrome* (last modified Nov. 9, 2000) <http://www.epa.gov/iaq/pubs/sbs.html>.

[104]Carrie A. Redlich, Judy Sparer & Mark Cullen, *Sick-building Syndrome*, 349 The Lancet 1013 (Apr. 5, 1997).

[105]*See Minner*, *supra* note 98.

[106]EPA, *supra* note 100.

causative agents for BRI.[107]

MCS is neither defined nor widely accepted as an organic entity by mainstream medicine.[108] Most courts have not recognized the diagnosis of MCS as a scientifically valid diagnosis.[109] Thus, most courts have agreed with the recent Delaware court which held "that MCS as a disease has not reached the threshold of reliability needed to survive a *Daubert* inquiry."[110]

CFS is defined by the CDC for research purposes as: "persistent or relapsing fatigue lasting greater than six months that is unexplained by any other physical disorder...." It is accepted as a scientifically valid diagnosis by the medical community. However, the causal link that a sick building can cause a person to acquire CFS does not have a valid scientific foundation.[111] Thus, the courts have been unable to allow a CFS cause of action to stand in a sick building case.[112]

FM is associated with chronic pain and dysregulation of neuroendocrine function and of sleep. The medical community, as well as courts, recognize that FM is a diagnosable condition. However, there appears to be a consensus by the medical community that no known cause of FM has been established.[113] Thus, courts have also acknowledged that the cause of FM

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[107]Dick Menzies & Jean Bourbeau, *Building Related Illnesses*, 337 The New England Journal of Medicine 1524 (Nov. 20, 1997).

[108]Ronald E. Gotts & Tamar D. Hamosh, *Multiple Chemical Sensitivities: A Symposium on the State of the Science*, 18 Regulatory Toxicology and Pharmacology 61, 62 (Aug. 1993).

[109]*Coffey v. County of Hennepin, D.Minn.*, 23 F.Supp.2d 1081, 1086 (1998) (citing *Brown v. Shalala*, 8th Cir., 15 F.3d 97, 100 (1994); *Collins v. Welsh*, 678 N.Y.S2d 444 (N.Y. Supr. 1998); *but see, Creamer v. Callahan*, 981 F.Supp. 703, 705 (D. Mass. 1997) (remanding case to ALJ because the Social Security Administration recognizes MCS as a medically determinable impairment).

[110]*See Minner*, *supra* note 98.

[111]The Management of Chronic Fatigue Syndrome; A Statement for the Advisory Board of the American Association for Chronic Fatigue Syndrome (visited Dec. 14, 2000) <http://www.aacfs.org/html/management.htm>.

[112]See e.g., *Mitchell v. Eastman Kodak Co.*, 113 F.3d 433, 443 (3d Cir. 1997) ("the disease...has no known etiology.").

[113]The Physical Medicine Research Foundation, *The Fibromyalgia Syndrome: A Consensus Report on Fibromyalgia and Disability*, 23 Journal of Rheumatology 3 (1996) (illustrating that data regarding the causality of FM are largely absent).

is still unknown. The U.S. Court of Appeals for the Fifth Circuit noted that "[e]xperts in the field conclude that the ultimate cause of FM cannot be known and only an educated guess can be made based on the patient's history."[114]

RADS is a valid scientific diagnosis with known causes of the illness.[115] RADS appears to be triggered by the sudden onset of asthma following a high-level irritant, gas, vapor, or fume exposure.[116] However, thus far, RADS has not been raised as an injury in a mold infestation building case. Therefore, it is not known if this will be deemed to be a successful cause of action in the courts.

RAIDS, which is defined as "a condition...whereby asthma symptoms appear to be initiated by low-or-moderate-level exposure to an irritant substance or material in the workplace or environment, and is characterized clinically by the development of asthma symptoms and physiologically by the finding of an atopic status and the presence of non-specific airway hyperresponsiveness."[117] Like RADS, RAIDS has also yet to be litigated in a mold building infestation case.

Chronic TE is defined as an acquired mental impairment, affecting intellect, memory, emotions, and personality.[118] It is recognized by the medical community as a scientifically diagnosable condition.[119] However, there is a disagreement among the scientific community that mold in a building can cause TE. Robert Feldman notes that organic solvents can cause TE.[120] However, he also states that it may be difficult to identify a specific causative agent in the workplace and further states that chronic solvent exposure can be associated with

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[114]*Black v. Food Lion Inc.*, 171 F.3d 308, 313 (5th Cir. 1999).

[115]*See Minner, supra* note 98.

[116]Stuart M. Brooks et al., *The Spectrum of Irritant-Induced Asthma*, 113 Chest 42 (Jan. 1998) (concluding that preexisting allergic/atopy and/or preexisting asthma were significant contributors to the pathogenesis of not-so-sudden, irritant-induced asthma).

[117]Stewart M. Brooks, *Reactive Airway Syndromes*, 215 Journal of Occupational Health and Medicine 1 (1992).

[118]World Health Organization & Nordic Council of Ministers, *Chronic Effects of Organic Solvents on the Central Nervous System and Diagnostic Criteria* (reprinted by the U.S. Department of Health and Human Services, Public Health Service, 1985).

[119]*See Minner, supra* note 98.

[120]Robert G. Feldman, *Neurotoxic Disorders*, Handbook of Occupational Medicine 179, 186-87 (Robert J. McCunney 1988).

cognitive changes in an individual.[121] Hence, while TE did meet the standard of admissibility under *Daubert* in a recent Delaware case, the case was settled before fully litigated. Thus TE has not yet been successfully litigated in a mold infestation building case.

E. Damages recoverable in mold cases

The general principles for recovering damages vary from state to state. In most states, the general principle governing the measure of damages entitles an injured party to recover full compensation for losses proximately caused by a wrongdoer's act or omission.

On personal injury claims arising from toxic mold related illness, depending on state law, the types of damages sought by plaintiffs include: (1) pain and suffering; (2) past, present and future medical care; (3) future medical monitoring; (4) lost wages; and (5) loss of earning capacity.[122] In rare cases where a death has occurred as a result of exposure to molds, a wrongful death claim can be made by the surviving family members for (1) loss of love, companionship, comfort, affection, society, solace or moral support; (2) any loss of enjoyment or sexual relations; or (3) loss of physical assistance to a spouse in the operation or maintenance of the home.[123] Survivors can also recover for lost financial support from the decedent.[124]

Prejudgment interest can also be recovered in some states to compensate the plaintiff for the loss of use of his money or property.

Punitive damages may be also justified in a mold contamination case when the evidence establishes that the defendant was aware of the probable dangerous consequences of his conduct (i.e., the mold condition on his property) and the defendant willfully and deliberately failed to act to avoid those consequences (i.e., fails to remediate the dangerous condition).[125]

Emotional distress damages may also be recoverable in cases involving personal injury. However, emotional distress damages cannot be recovered where the injury is confined to

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[121] Id.

[122] Information provided by Sheri Mullikin, Kathleen Sullivan, & Sky Woodward, Attys., of Miles & Stockbridge P.C. in Baltimore, MD.

[123] *See Peaspanan v. Board of Education*, 669 N.E.2d 284 (Ohio Ct. App. 1995).

[124] *Supra*, note 119; *see also* California Jury Instruction BAJI Nos. 14.50-14.52.

[125] *Penner v. Falk*, 200 Cal.Rptr. 661 (Cal. Ct. App. 1984).

property damage.[126]

F. Recent litigation, verdicts, and settlements

The rise of mold contamination cases being reported in the media and medical journals has led to published verdicts and settlements in legal publications. However, because most of these cases involve a recovery for both property damage to repair and remediate the defective conditions, as well as for personal injury, it is difficult to extract an amount paid for each category of damage. Nonetheless, below is a representative sample of recent litigation involving mold infestation in apartment buildings.

In 1999, 140 lawsuits were filed against two New York City apartment building owners seeking $60 million per plaintiff, for a total of $30 billion in compensatory and punitive damages for personal injuries allegedly sustained from exposure to mold contamination.[127] The residents allege that the toxic mold outbreak is due to water leaks that have plagued the 28-year old building. Additionally, the family of a seven year-old girl who died in 1998 from asthma-related causes intends to file a wrongful death suit against the property owners under the theory that her condition was "aggravated and worsened by the mold conditions,"[128] according to the lawyer representing the residents.

In May of 1999, a Simi Valley, CA, woman recovered $350,000 against her homeowner association for failure to repair and remediate chronic water damage to her condominium and for her personal injuries suffered from exposure to toxic molds, including *Stachybotrys*.[129]

In February of 1998, three families in Alameda County, CA, settled their case against their homeowner's association for $545,000 after leaky pipes caused toxic mold to grow in the crawl spaces of their condo units. The plaintiffs reported depression, anxiety, emotional distress, gastrointestinal maladies, vomiting, diarrhea, respiratory tract infections, severe headaches, fatigue, lethargy and other symptoms. Blood samples showed elevated anti-bodies to neurotoxin-producing molds, including *Stachybotrys, Aspergillus* and

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[126]*Erlich v. Menendez*, 71 Cal.Rptr.2d 137 (Cal. Ct. App. 1998).

[127]*First of Mold Lawsuits Seeking $30 Billion from Landlord Is Set for Trial***,** 13 IAQ Strategies 11, Nov. 2000.

[128]Salvatore Arena, *Mold's Toxic, Tenants Say In $8B Suit*, New York Daily News, May 18, 1999.

[129] *See* Robertson, supra note 11, at 34 (*citing* Tri-Service Reference No. S99-09-19; *Hickenbottom v. Raquet Club Villa HOA*, No. SC 020 526 (settlement May 17, 1999)).

Penicillium.[130]

In May of 1999, a Delaware Superior Court ruled that an apartment owner is liable to a resident whose health was damaged from exposure to toxic molds on the property.[131] The resident claimed that by failing to repair leaky roofs and defective bathroom plumbing, the property owner caused the resident's exposure to harmful mold, fungi and other toxic substances. This exposure was alleged to have left the resident with severe asthma attacks; mental and emotional injuries requiring ongoing medical care; and sustained cognitive deficiencies. Although the plaintiff was a cigarette smoker with a history of childhood allergies and asthma, the jury awarded the plaintiff approximately $780,000 in damages. The court denied a motion by the property owner asking for relief from the jury verdict because the damages award was speculative and so excessive that it should shock the judicial conscience. In making the denial, the court held that a jury could reasonably conclude that the plaintiff noted a worsening of her asthma symptoms after exposure to the environmental conditions found on the property. On appeal to the Delaware Supreme Court in May 2001, the Court affirmed the lower court's decision in favor of the resident. The Court held that "the Landlord Tenant Code imposes a duty on landlords to maintain the leased premises in a safe, sanitary condition and that an injured tenant may recover for personal injuries sustained as a result of landlord's negligent failure to do so."[132] The Court also upheld the lower court's decision to admit expert testimony on causation. The property owner had argued that the experts failed to establish a baseline from which to compare the mold levels in the resident's unit and failed to eliminate other possible causes of resident's medical complaints. In response, the Delaware Supreme Court stated, "[t]he foundation for an expert's causation opinion need not be established with the precision of a laboratory experiment," thus supporting the lower court's decision to admit the causation opinions.

In California in 1999, a family collected a nearly $525,000 settlement after they sued the apartment owner and managers over health problems caused by exposure to molds.[133] The family alleged that the property owners and managers knowingly rented out an apartment in

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[130]*See* Robertson, supra note 11, at 34 (*citing* Confidential Report for Attorneys, CRA No. 9855; 1988 Issue; pg. 08-76; *Berry, et. al. v. Mission Terrace HOA, et. al.* ACSC case no. H-182260-5 (Alameda County Super. Ct., Cal)).

[131]*Stroot v. New Haverford Partnership,* No. 95C-05-074-HLA, 1999 WL 753916 (Del. Super. Ct. May 11, 1999).

[132]*New Haverford Partnership v. Stroot,* 2001 WL 493216 (Del.Supr.).

[133]Bill Callahan, *Suit Over Mold in Apartments is Settled*, San Diego Union-Tribune, Jan. 9, 1999.

which exposure to dangerous fungi caused severe allergies. They contend the apartment management repeatedly ignored their complaints of musty odors and mold growth in the apartment and failed to inform them of the prior history of complaints regarding that and other units within the 700 unit building.

In 1998, a California woman was awarded a jury verdict of $495,000 after suing her condominium association for failure to repair repeated water intrusions.[134] As a result, mold growth occurred in which she claimed damages for the development of a mold allergy, necessity for continued medical care, pain and suffering, emotional distress, and the cost of repair. Along with the monetary award, the association was also ordered to make the necessary repairs.

In April of 1996, an Indian River, FL, jury awarded Martin County $11.45 million against a construction manager and three surety companies for SBS and construction defects. In the largest published verdict of its kind, a $14.2 million judgment was recently affirmed by the Florida Court of Appeals against the contractor of the Martin County Courthouse in *Centex-Rooney Construction Co. Inc., et al. v. Martin County*.[135] The county alleged it was forced to evacuate two buildings in December 1992 because the buildings suffered from construction defects, resulting in leaks to the building's exterior skin and problems with the air conditioning. Water intrusion and high humidity encouraged the growth of toxic molds and mildew in the buildings. The jury verdict only dealt with property damage and did not include any personal injury claims, which were the subject of separate cases. The trial judge reduced the jury's award by $2.75 million, reflecting the amount received by the county in pre-trial settlements with other defendants. The court entered an amended final judgement for $14.2 million, including $8.8 million in damages and $3.4 million in prejudgment interest.

The affirmation by the court on the causation issue is the most significant portion of the appellate decision. The appellate court upheld the trial judge's admission of expert testimony by two doctors who suggested the existence of a health hazard stemming from the presence of toxic molds in the buildings. The court of appeal held that the county met its burden of proof under *Frye v. U.S.* [136] noting that both experts testified about numerous publications accepted by the scientific community recognizing the link between toxic mold exposure and adverse

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[134]*Moller v. Atherton Homeowners Ass'n*, No. BC 161 657 (L.A. County Super. Ct., Cal.).

[135]7 Mealey's Litigation Report: Emerging Toxic Torts 21 (Feb. 5, 1999); 706 So.2d 20 (1998).

[136]54 App. D.C. 46, 293 F. 1013 D.C. Cir (1923).

health problems.[137]

In another Florida case, *Stillman v. South Florida Savings and Loan*[138], a bank tenant brought indoor air pollution-related counterclaims against its property owner/manager after evacuating an allegedly sick building. The bank asserted that its employees suffered from SBS and had requested that the property owner/manager investigate and remediate the problem. After these requests were not addressed to the bank's satisfaction, the bank vacated the premises. The property owner sued the bank for breach of its lease and the bank counterclaimed by alleging that the property owner's failure to properly maintain the air-conditioning system was a breach of the lease. The bank also asserted that the indoor air problem interfered with the bank's right to quiet enjoyment of the premises, constituted a constructive eviction from the property, and was the result of the owner/manager's negligence. This case was ultimately resolved by the parties, but only after considerable litigation.[139] The amount of the settlement remains undisclosed.

IX. CONCLUSION

The list of potential plaintiffs and defendants seems almost limitless. Residents/occupants have sued building owners and managers, the owners and managers have sued designers, architects, contractors, surety companies, and just about everyone connected with the design and operation of the building. The legal landscape is fraught with danger over IAQ issues. There are no controlling federal regulations concerning IAQ or exposure to molds. As the issue of mold in the residential environment captures the public's attention, the suits in this area are bound to increase.[140]

In order to avoid liability due to mold contamination, property owners/managers should institute appropriate maintenance protocols. If a mold complaint does arise, you may still

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[137]*Centex-Rooney Construction Company Co. et. al. v. Martin County*, 706 So.2d 20 (Fla. Dist. Ct. App. 1998).

[138]*See* Laurence S. Kirsch and Brian W. Hayle Esq., *Avoiding Litigation, Indoor Air Pollution Plaintiffs-Who Are They?,* IEQ Strategies-Managing Risk in the Indoor Environment: A Practical Handbook, 11, 17 (Carlton Vogt ed., Cutter Information Corp., 1998).

[139] Id.

[140]Carlton Vogt, *Ignoring the Indoor Environment: An Invitation to Trouble*, IEQ Strategies-Managing Risk in the Indoor Environment: A Practical Handbook, 5, 6 (Carlton Vogt ed., Cutter Information Corp.,1998).

protect yourself from a lawsuit by properly responding to the complaint while preparing to protect yourself from liability should the complaint move into litigation. It is best for both the property owner/manager and the residents to be prepared to address mold infestation problems immediately. The expense and publicity of a lawsuit can be costly and damaging to all parties involved.

Indoor Air Quality Complaint Form

This form can be filled out by the building occupant or by a member of the building staff.

Occupant Name: _____ Date: _____

Department/Location in Building: _____ Phone: _____

Completed by: _____ Title: _____ Phone: _____

This form should be used if your complaint may be related to indoor air quality. Indoor air quality problems include concerns with temperature control, ventilation, and air pollutants. Your observations can help to resolve the problem as quickly as possible. Please use the space below to describe the nature of the complaint and any potential causes.

We may need to contact you to discuss your complaint. What is the best time to reach you? _____

So that we can respond promptly, please return this form to: _____
IAQ Manager or Contact Person

_____
Room, Building, Mail Code

OFFICE USE ONLY

File Number: _____ Received By: _____ Date Received: _____

Incident Log

Building Name: _____ Dates (from): _____ (to): _____

Address: _____ Completed by (name):_____

File Number	Date	Problem Location	Investigation Record (check the forms that were used)									Outcome/Comments (use more than one line if needed)	Log Entry By (initials)
			Complaint Form	Occupant Interview	Occupant Diary	Log of Activities	Zone/Room Record	HVAC Checklist	Pollutant Pathway	Source Inventory	Hypothesis Form		

EPA

United States
Environmental Protection
Agency

Office of Air and Radiation,
Indoor Environments Division
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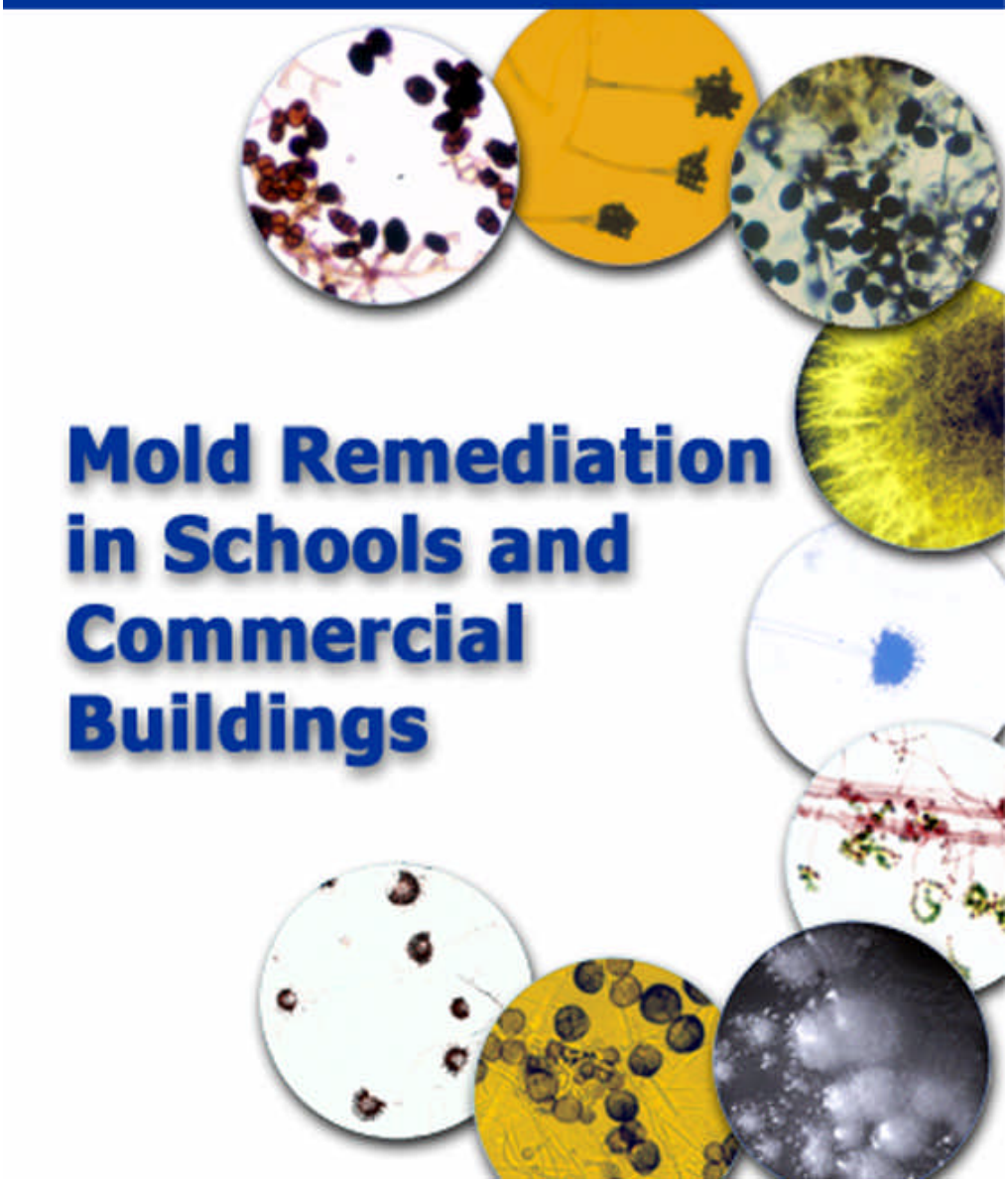

Mold Remediation in Schools and Commercial Buildings

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Please note that this document presents recommendations on mold remediation. EPA does not regulate mold or mold spores in indoor air.

This document is available as a text-searchable HTML document on EPA's web server at:
www.epa.gov/iaq/molds (last updated - June 25, 2001).
You can download an Adobe Acrobat version of this document at:
www.epa.gov/iaq/molds/graphics/moldremediation.pdf

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Mold Remediation in Schools and Commercial Buildings

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INTRODUCTION

Concern about indoor exposure to mold has been increasing as the public becomes aware that exposure to mold can cause a variety of health effects and symptoms, including allergic reactions. This document presents guidelines for the remediation/cleanup of mold and moisture problems in schools and commercial buildings; these guidelines include measures designed to protect the health of building occupants and remediators. It has been designed primarily for building managers, custodians, and others who are responsible for commercial building and school maintenance. It should serve as a reference for potential mold and moisture remediators. Using this document, individuals with little or no experience with mold remediation should be able to make a reasonable judgment as to whether the situation can be handled in-house. It will help those in charge of maintenance to evaluate an in-house remediation plan or a remediation plan submitted by an outside contractor.[1] Contractors and other professionals who respond to mold and moisture situations in commercial buildings and schools may also want to refer to these guidelines.

Molds gradually destroy the things they grow on. Prevent damage to building materials and furnishings, save money, and avoid potential health risks by controlling moisture and eliminating mold growth.

Photo 2: Extensive mold contamination of ceiling and walls

[1] If you choose to use outside contractors or professionals, make sure they have experience cleaning up mold, check their references, and have them follow the recommendations presented in this document, the guidelines of the American Conference of Government Industrial Hygienists (ACGIH) (see Resources List), and/or guidelines from other professional organizations.

Molds can be found almost anywhere; they can grow on virtually any organic substance, as long as moisture and oxygen are present. There are molds that can grow on wood, paper, carpet, foods, and insulation. When excessive moisture accumulates in buildings or on building materials, mold growth will often occur, particularly if the moisture problem remains undiscovered or unaddressed. It is impossible to eliminate all mold and mold spores in the indoor environment. However, mold growth can be controlled indoors by controlling moisture indoors.

Molds reproduce by making spores that usually cannot be seen without magnification. Mold spores waft through the indoor and outdoor air continually. When mold spores land on a damp spot indoors, they may begin growing and digesting whatever they are growing on in order to survive. Molds gradually destroy the things they grow on.

Many types of molds exist. All molds have the potential to cause health effects. Molds can produce allergens that can trigger allergic reactions or even asthma attacks in people allergic to mold. Others are known to produce potent toxins and/or irritants. Potential health concerns are an important reason to prevent mold growth and to remediate/clean up any existing indoor mold growth.

Since mold requires water to grow, it is important to prevent moisture problems in buildings. Moisture problems can have many causes, including uncontrolled humidity. Some moisture problems in buildings have been linked to changes in building construction practices during the 1970s, 80s, and 90s. Some of these changes have resulted in buildings that are tightly sealed, but may lack adequate ventilation, potentially leading to moisture buildup. Building materials, such as drywall, may not allow moisture to escape easily. Moisture problems may include roof leaks, landscaping or gutters that direct water into or under the building, and unvented combustion appliances. Delayed maintenance or insufficient maintenance are also associated with moisture problems in schools and large buildings. Moisture problems in portable classrooms and other temporary structures have frequently been associated with mold problems.

When mold growth occurs in buildings, adverse health problems may be reported by some building occupants, particularly those with allergies or respiratory problems. Remediators should avoid exposing themselves and others to mold-laden dusts as they conduct their cleanup activities. Caution should be used to prevent mold and mold spores from being dispersed throughout the air where they can be inhaled by building occupants.

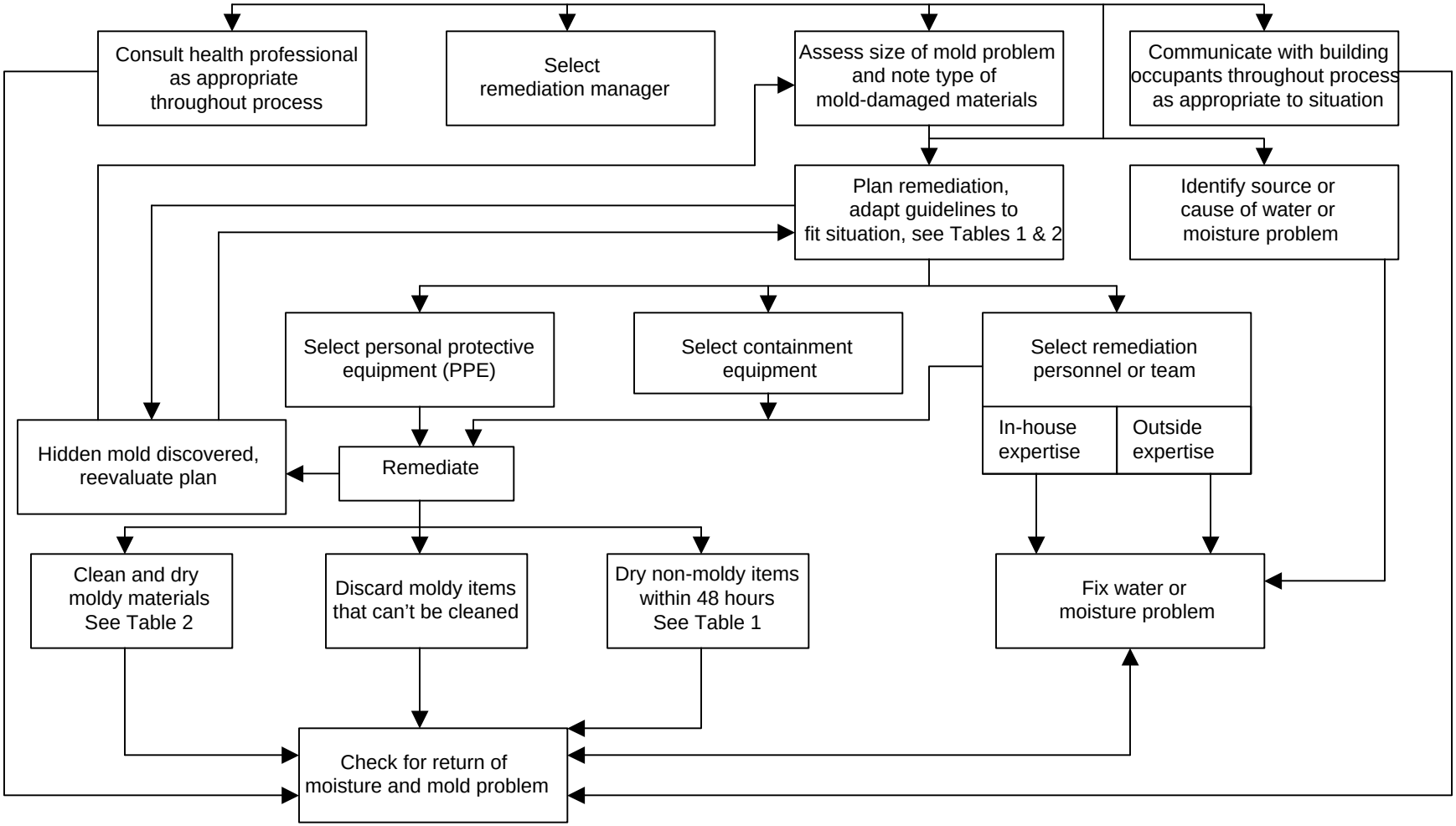
PREVENTION

The key to mold control is moisture control. Solve moisture problems before they become mold problems!

Mold Prevention Tips

- Fix leaky plumbing and leaks in the building envelope as soon as possible.
- Watch for condensation and wet spots. Fix source(s) of moisture problem(s) as soon as possible.
- Prevent moisture due to condensation by increasing surface temperature or reducing the moisture level in air (humidity). To increase surface temperature, insulate or increase air circulation. To reduce the moisture level in air, repair leaks, increase ventilation (if outside air is cold and dry), or dehumidify (if outdoor air is warm and humid).
- Keep heating, ventilation, and air conditioning (HVAC) drip pans clean, flowing properly, and unobstructed.
- Vent moisture-generating appliances, such as dryers, to the outside where possible.
- Maintain low indoor humidity, below 60% relative humidity (RH), ideally 30-50%, if possible.
- Perform regular building/HVAC inspections and maintenance as scheduled.
- Clean and dry wet or damp spots within 48 hours.
- Don't let foundations stay wet. Provide drainage and slope the ground away from the foundation.

Mold Remediation – Key Steps



INVESTIGATING, EVALUATING, AND REMEDIATING MOISTURE AND MOLD PROBLEMS

Safety Tips While Investigating and Evaluating Mold and Moisture Problems

- Do not touch mold or moldy items with bare hands.
- Do not get mold or mold spores in your eyes.
- Do not breathe in mold or mold spores.
- Consult Table 2 and text for Personal Protective Equipment (PPE) and containment guidelines.
- Consider using PPE when disturbing mold. The minimum PPE is an N-95 respirator, gloves, and eye protection.

Moldy Areas Encountered During an Investigation

Photo 3A: Mold growing in closet as a result of condensation from room air

Photo 3B: Front side of wall-board looks fine, but the back side is covered with mold

PLAN THE REMEDIATION BEFORE STARTING WORK

Questions to Consider Before Remediating

- Are there existing moisture problems in the building?
- Have building materials been wet more than 48 hours? (See Table 2 and text)
- Are there hidden sources of water or is the humidity too high (high enough to cause condensation)?
- Are building occupants reporting musty or moldy odors?
- Are building occupants reporting health problems?
- Are building materials or furnishings visibly damaged?
- Has maintenance been delayed or the maintenance plan been altered?
- Has the building been recently remodeled or has building use changed?
- Is consultation with medical or health professionals indicated?

Remediation Plan

Assess the size of the mold and/or moisture problem and the type of damaged materials before planning the remediation work. Select a remediation manager for medium or large jobs (or small jobs requiring more than one person). The remediation plan should include steps to fix the water or moisture problem, or the problem may reoccur. The plan should cover the use of appropriate Personal Protective Equipment (PPE) and include steps to carefully contain and remove moldy building materials to avoid spreading the mold.[2] A remediation plan may vary greatly depending on the size and complexity of the job, and may require revision if circumstances change or new facts are discovered.

The remediation manager's highest priority must be to protect the health and safety of the building occupants and remediators. It is also important to communicate with building occupants when mold problems are identified.[3] In some cases,

[2] Molds are known allergens and may be toxic. You may wish to use Personal Protective Equipment (PPE) while investigating a mold problem, as well as during remediation/clean-up situations. The minimum PPE includes an N-95 respirator, gloves, and eye protection.

[3] See Appendix C.

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. If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected.

Remediators, particularly those with health-related concerns, may wish to check with their doctors or health care professionals before working on mold remediation or investigating potentially moldy areas. If you have any doubts or questions, you should consult a health professional before beginning a remediation project.

HVAC System

Do not run the HVAC system if you know or suspect that it is contaminated with mold. If you suspect that it may be contaminated (it is part of an identified moisture problem, for instance, or there is mold growth near the intake to the system), consult EPA's guide *Should You Have the Air Ducts in Your Home Cleaned?*[4] before taking further action (see Resources List).

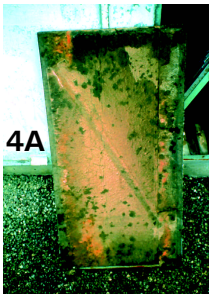


Photo 4A: Contaminated fibrous insulation inside air handler cover

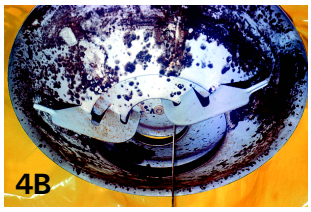


Photo 4B: Mold growth on air diffuser in ceiling

Photo 4C: Moldy air duct

[4] Although this document has a residential focus, it is applicable to other building types.

Hidden Mold Growth

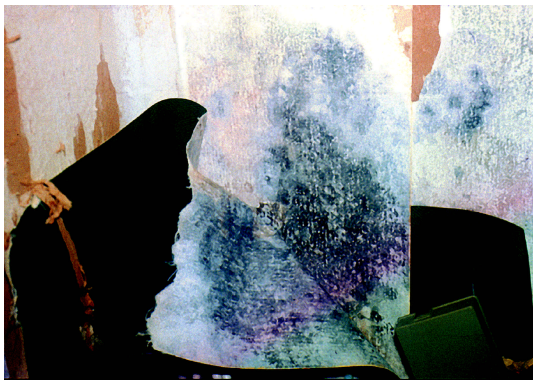


Photo 5: Mold growth behind wallpaper

Hidden Mold

In some cases, indoor mold growth may not be obvious. It is possible that mold may be growing on hidden surfaces, such as the back side of dry wall, wallpaper, or paneling, the top of ceiling tiles, the underside of carpets and pads, etc. Possible locations of hidden mold can include pipe chases and utility tunnels (with leaking or condensing pipes), walls behind furniture (where condensation forms), condensate drain pans inside air handling units, porous thermal or acoustic liners inside ductwork, or roof materials above ceiling tiles (due to roof leaks or insufficient insulation). Some building materials, such as dry wall with vinyl wallpaper over it or wood paneling, may act as vapor barriers,[5] trapping moisture underneath their surfaces and thereby providing a moist environment where mold can grow. You may suspect hidden mold if a building smells moldy, but you cannot see the source, or if you know there has been water damage and building occupants are reporting health problems. Investigating hidden mold problems may be difficult and will require caution when the investigation involves disturbing potential sites of mold growth—make sure to use PPE. For example, removal of wallpaper can lead to a massive release of spores from mold growing on the underside of the paper. If you believe that you may have a hidden mold problem, you may want to consider hiring an experienced professional. If you discover hidden mold, you should revise your remediation plan to account for the total area affected by mold growth.

[5] For more information on vapor barriers and building construction, see Resources List. It is important that building materials be able to dry; moisture should not be trapped between two vapor barriers or mold may result.

REMEDIATION

1. Fix the water or humidity problem. Complete and carry out repair plan if appropriate. Revise and/or carry out maintenance plan if necessary. Revise remediation plan as necessary, if more damage is discovered during remediation. See Mold Remediation – Key Steps (page 5) and Resources List (page 29) for additional information.

2. Continue to communicate with building occupants, as appropriate to the situation. Be sure to address all concerns.

3. Completely clean up mold and dry water-damaged areas. Select appropriate cleaning and drying methods for damaged/contaminated materials. Carefully contain and remove moldy building materials. Use appropriate Personal Protective Equipment (PPE). Arrange for outside professional support if necessary.

The Key to Mold Control is Moisture Control!

- When addressing mold problems, don't forget to address the source of the moisture problem, or the mold problem may simply reappear!
- Remember to check for high humidity and condensation problems as well as actual water leaks, maintenance issues, and HVAC system problems.
- Protect the health and safety of the building occupants and remediators. Consult a health professional as needed. Use PPE and containment as appropriate when working with mold.

Table 1: Water Damage Cleanup and Mold Prevention[6]

Table 1 presents strategies to respond to water damage within 24-48 hours. These guidelines are designed to help avoid the need for remediation of mold growth by taking quick action before growth starts. If mold growth is found on the materials listed in Table 1, refer to Table 2 for guidance on remediation. Depending on the size of the area involved and resources available, professional assistance may be needed to dry an area quickly and thoroughly.

[6] Please note that Tables 1 and 2 contain general guidelines. Their purpose is to provide basic information for remediation managers to first assess the extent of the damage and then to determine whether the remediation should be managed by in-house personnel or outside professionals. The remediation manager can then use the guidelines to help design a remediation plan or to assess a plan submitted by outside professionals.

Table 1: Water Damage – Cleanup and Mold Prevention

Guidelines for Response to Clean Water Damage within 24-48 Hours to Prevent Mold Growth*

Water-Damaged Material†	Actions
Books and papers	* For non-valuable items, discard books and papers. * Photocopy valuable/important items, discard originals. * Freeze (in frost-free freezer or meat locker) or freeze-dry.
Carpet and backing – dry within 24-48 hours§	* Remove water with water extraction vacuum. * Reduce ambient humidity levels with dehumidifier. * Accelerate drying process with fans.
Ceiling tiles	* Discard and replace.
Cellulose insulation	* Discard and replace.
Concrete or cinder block surfaces	* Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters.
Fiberglass insulation	* Discard and replace.
Hard surface, porous flooring§ (Linoleum, ceramic tile, vinyl)	* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary. * Check to make sure underflooring is dry; dry underflooring if necessary.
Non-porous, hard surfaces (Plastics, metals)	* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	* Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters. * May be difficult to completely dry within 48 hours. If the piece is valuable, you may wish to consult a restoration/water damage professional who specializes in furniture.
Wallboard (Drywall and gypsum board)	* May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard, and replace. * Ventilate the wall cavity, if possible.
Window drapes	* Follow laundering or cleaning instructions recommended by the manufacturer.
Wood surfaces	* Remove moisture immediately and use dehumidifiers, gentle heat, and fans for drying. (Use caution when applying heat to hardwood floors.) * Treated or finished wood surfaces may be cleaned with mild detergent and clean water and allowed to dry. * Wet paneling should be pried away from wall for drying.

*If mold growth has occurred or materials have been wet for more than 48 hours, consult Table 2 guidelines. Even if materials are dried within 48 hours, mold growth may have occurred. Items may be tested by professionals if there is doubt. Note that mold growth will not always occur after 48 hours; this is only a guideline.

These guidelines are for damage caused by clean water. If you know or suspect that the water source is contaminated with sewage, or chemical or biological pollutants, then Personal Protective Equipment and containment are required by OSHA. An experienced professional should be consulted if you and/or your remediators do not have expertise remediating in contaminated water situations. Do not use fans before determining that the water is clean or sanitary.

† If a particular item(s) has high monetary or sentimental value, you may wish to consult a restoration/water damage specialist.

§ The subfloor under the carpet or other flooring material must also be cleaned and dried. See the appropriate section of this table for recommended actions depending on the composition of the subfloor.

Table 2: Mold Remediation Guidelines[7]

Mold and Indoor Air Regulations and Standards

Standards or Threshold Limit Values (TLVs) for airborne concentrations of mold, or mold spores, have not been set. As of December 2000, there are no EPA regulations or standards for airborne mold contaminants.

Table 2 presents remediation guidelines for building materials that have or are likely to have mold growth. The guidelines in Table 2 are designed to protect the health of occupants and cleanup personnel during remediation. These guidelines are based on the area and type of material affected by water damage and/or mold growth. Please note that these are guidelines; some professionals may prefer other cleaning methods. If you are considering cleaning your ducts as part of your remediation plan, you should consult EPA's publication entitled, *Should You Have the Air Ducts In Your Home Cleaned?*[8] (see Resources List). If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected.

Although the level of personal protection suggested in these guidelines is based on the total surface area contaminated and the potential for remediator and/or occupant exposure, professional judgment should always play a part in remediation decisions. These remediation guidelines are based on the size of the affected area to make it easier for remediators to select appropriate techniques, not on the basis of health effects or research showing there is a specific method appropriate at a certain number of square feet. The guidelines have been designed to help construct a remediation plan. The remediation manager will then use professional judgment and experience to adapt the guidelines to particular situations. When in doubt, caution is advised. Consult an experienced mold remediator for more information.

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[7] Please note that Tables 1 and 2 contain general guidelines. Their purpose is to provide basic information for remediation managers to first assess the extent of the damage and then to determine whether the remediation should be managed by in-house personnel or outside professionals. The remediation manager can then use the guidelines to help design a remediation plan or to assess a plan submitted by outside professionals.

[8] Although this document has a residential focus, it is applicable to other building types.

In cases in which a particularly toxic mold species has been identified or is suspected, when extensive hidden mold is expected (such as behind vinyl wallpaper or in the HVAC system), when the chances of the mold becoming airborne are estimated to be high, or sensitive individuals (e.g., those with severe allergies or asthma) are present, a more cautious or conservative approach to remediation is indicated. Always make sure to protect remediators and building occupants from exposure to mold.

Health Concerns

If building occupants are reporting serious health concerns, you should consult a health professional.

Table 2: Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water*

Material or Furnishing Affected	Cleanup Methods†	Personal Protective Equipment	Containment
SMALL – Total Surface Area Affected Less Than 10 square feet (ft^2)			
Books and papers	3	Minimum N-95 respirator, gloves, and goggles	None required
Carpet and backing	1, 3		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3		
Wallboard (drywall and gypsum board)	3		
Wood surfaces	1, 2, 3		
MEDIUM – Total Surface Area Affected Between 10 and 100 (ft^2)			
Books and papers	3	Limited or Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Limited Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3		
LARGE – Total Surface Area Affected Greater Than 100 (ft^2) or Potential for Increased Occupant or Remediator Exposure During Remediation Estimated to be Significant			
Books and papers	3	Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Full Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	1, 2, 3, 4		
Non-porous, hard surfaces (plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3, 4		

Table 2 continued

*Use professional judgment to determine prudent levels of Personal Protective Equipment and containment for each situation, particularly as the remediation site size increases and the potential for exposure and health effects rises. Assess the need for increased Personal Protective Equipment, if, during the remediation, more extensive contamination is encountered than was expected. Consult Table 1 if materials have been wet for less than 48 hours, and mold growth is not apparent.

These guidelines are for damage caused by clean water. If you know or suspect that the water source is contaminated with sewage, or chemical or biological pollutants, then the Occupational Safety and Health Administration (OSHA) requires PPE and containment. An experienced professional should be consulted if you and/or your remediators do not have expertise in remediating contaminated water situations.

†Select method most appropriate to situation. Since molds gradually destroy the things they grow on, if mold growth is not addressed promptly, some items may be damaged such that cleaning will not restore their original appearance. If mold growth is heavy and items are valuable or important, you may wish to consult a restoration/water damage/remediation expert. Please note that these are guidelines; other cleaning methods may be preferred by some professionals.

CLEANUP METHODS

Method 1: Wet vacuum (in the case of porous materials, some mold spores/fragments will remain in the material but will not grow if the material is completely dried). Steam cleaning may be an alternative for carpets and some upholstered furniture.
Method 2: Damp-wipe surfaces with plain water or with water and detergent solution (except wood —use wood floor cleaner); scrub as needed.
Method 3: High-efficiency particulate air (HEPA) vacuum after the material has been thoroughly dried. Dispose of the contents of the HEPA vacuum in well-sealed plastic bags.
Method 4: Discard – remove water-damaged materials and seal in plastic bags while inside of containment, if present. Dispose of as normal waste. HEPA vacuum area after it is dried.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Minimum: Gloves, N-95 respirator, goggles/eye protection
Limited: Gloves, N-95 respirator or half-face respirator with HEPA filter, disposable overalls, goggles/eye protection
Full: Gloves, disposable full body clothing, head gear, foot coverings, full-face respirator with HEPA filter

CONTAINMENT

Limited: Use polyethylene sheeting ceiling to floor around affected area with a slit entry and covering flap; maintain area under negative pressure with HEPA filtered fan unit. Block supply and return air vents within containment area.
Full: Use two layers of fire-retardant polyethylene sheeting with one airlock chamber. Maintain area under negative pressure with HEPA filtered fan exhausted outside of building. Block supply and return air vents within containment area.

Table developed from literature and remediation documents including *Bioaerosols: Assessment and Control* (American Conference of Governmental Industrial Hygienists, 1999) and *IICRC S500, Standard and Reference Guide for Professional Water Damage Restoration* (Institute of Inspection, Cleaning and Restoration, 1999); see Resources List for more information.

Cleanup Methods

A variety of mold cleanup methods are available for remediating damage to building materials and furnishings caused by moisture control problems and mold growth. The specific method or group of methods used will depend on the type of material affected, as presented in Table 2. Please note that professional remediators may use some methods not covered in these guidelines; absence of a method in the guidelines does not necessarily mean that it is not useful.[9]

Molds Can Damage Building Materials and Furnishings

Mold growth can eventually cause structural damage to a school or large building, if a mold/moisture problem remains unaddressed for a long time. In the case of a long-term roof leak, for example, molds can weaken floors and walls as the molds feed on wet wood. If you suspect that mold has damaged building integrity, you should consult a structural engineer or other professional with expertise in this area.

Photo 6: Heavy mold growth on underside of spruce floorboards

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

[9] If you are unsure what to do, or if the item is expensive or of sentimental value, you may wish to consult a specialist. Specialists in furniture repair/restoration, painting, art restoration and conservation, carpet and rug cleaning, water damage, and fire/water restoration are commonly listed in phone books. Be sure to ask for and check references; look for affiliation with professional organizations. See Resources List.

should be used only when materials are still wet—wet vacuums may spread spores if sufficient liquid is not present. The tanks, hoses, and attachments of 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 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, the mold can be difficult or impossible to remove completely.

Mold and Paint

Don't paint or caulk moldy surfaces; clean and dry surfaces before painting. Paint applied over moldy surfaces is likely to peel.

Method 3: HEPA Vacuum

HEPA (High-Efficiency Particulate Air) 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 assure that the filter is properly seated in the vacuum so that all the air must pass through the filter. When changing the vacuum filter, remediators should wear PPE to prevent exposure to the mold that has been captured. The filter and contents of the HEPA vacuum must be disposed of in well-sealed plastic bags.

Mold Remediation/Cleanup and Biocides

The purpose of mold remediation is to remove the mold to prevent human exposure and damage to building materials and furnishings. It is necessary to clean up mold contamination, not just to kill the mold. Dead mold is still allergenic, and some dead molds are potentially toxic. The use of a biocide, such as chlorine bleach, is not recommended as a routine practice during mold remediation, although there may be instances where professional judgment may indicate its use (for example, when immune-compromised individuals are present). In most cases, it is not possible or desirable to sterilize an area; a background level of mold spores will remain in the air (roughly equivalent to or lower than the level in outside air). These spores will not grow if the moisture problem in the building has been resolved.

If you choose to use disinfectants or biocides, always ventilate the area. Outdoor air may need to be brought in with fans. When using fans, take care not to distribute mold spores throughout an unaffected area. Biocides are toxic to humans, as well as to mold. You should also use appropriate PPE and read and follow label precautions. Never mix chlorine bleach solution with cleaning solutions or detergents that contain ammonia; toxic fumes could be produced.

Some biocides are considered pesticides, and some States require that only registered pesticide applicators apply these products in schools. Make sure anyone applying a biocide is properly licensed, if necessary. Fungicides are commonly applied to outdoor plants, soil, and grains as a dust or spray—examples include hexachlorobenzene, organomercurials, pentachlorophenol, phthalimides, and dithiocarbamates. Do not use fungicides developed for use outdoors for mold remediation or for any other indoor situation.

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 6-mil polyethylene 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 polyethylene sheeting and sealed with duct tape before they are removed from the containment area.

Personal Protective Equipment (PPE)

Always use gloves and eye protection when cleaning up mold!

If the remediation job disturbs mold and mold spores become airborne, then the risk of respiratory exposure goes up. Actions that are likely to stir up mold include: breakup of moldy porous materials such as wallboard; invasive procedures used to examine or remediate mold growth in a wall cavity; actively stripping or peeling wallpaper to remove it; and using fans to dry items.

The primary function of Personal Protective Equipment (PPE) is to avoid inhaling mold and mold spores and to avoid mold contact with the skin or eyes. The following sections discuss the different types of PPE that can be used during remediation activities. Please note that all individuals using certain PPE equipment, such as half-face or full-face respirators, must be trained, must have medical clearance, and must be fit-tested by a trained professional. In addition, the use of respirators must follow a complete respiratory protection program as specified by the Occupational Safety and Health Administration (see Resources List for more information).

Personal Protective Equipment

Photo 7: Remediation worker with limited PPE

Skin and Eye Protection

Gloves are required to protect the skin from contact with mold allergens (and in some cases mold toxins) and from potentially irritating cleaning solutions. Long gloves that extend to the middle of the forearm are recommended. The glove material should

be selected based on the type of materials being handled. If you are using a biocide (such as chlorine bleach) or a strong cleaning solution, you should select gloves made from natural rubber, neoprene, nitrile, polyurethane, or PVC. If you are using a mild detergent or plain water, ordinary household rubber gloves may be used.

To protect your eyes, use properly fitted goggles or a full-face respirator with HEPA filter. Goggles must be designed to prevent the entry of dust and small particles. Safety glasses or goggles with open vent holes are not acceptable.

Respiratory Protection

Respirators protect cleanup workers from inhaling airborne mold, mold spores, and dust.

Minimum: When cleaning up a small area affected by mold, you should use an N-95 respirator. This device covers the nose and mouth, will filter out 95% of the particulates in the air, and is available in most hardware stores.

Limited: Limited PPE includes use of a half-face or full-face air purifying respirator (APR) equipped with a HEPA filter cartridge. These respirators contain both inhalation and exhalation valves that filter the air and ensure that it is free of mold particles. Note that half-face APRs do not provide eye protection. In addition, the HEPA filters do not remove vapors or gases. You should always use respirators approved by the National Institute for Occupational Safety and Health (see Resources List).

Full: In situations in which high levels of airborne dust or mold spores are likely or when intense or long-term exposures are expected (e.g., the cleanup of large areas of contamination), a full-face, powered air purifying respirator (PAPR) is recommended. Full-face PAPRs use a blower to force air through a HEPA filter. The HEPA-filtered air is supplied to a mask that covers the entire face or a hood that covers the entire head. The positive pressure within the hood prevents unfiltered air from entering through penetrations or gaps. Individuals must be trained to use their respirators before they begin remediation. The use of these respirators must be in compliance with OSHA regulations (see Resources List).

Disposable Protective Clothing

Disposable clothing is recommended during a medium or large remediation project to prevent the transfer and spread of mold to clothing and to eliminate skin contact with mold.

Limited: Disposable paper overalls can be used.

Full: Mold-impervious disposable head and foot coverings, and a body suit made of a breathable material, such as TYVEK®, should be used. All gaps, such as those around ankles and wrists, should be sealed (many remediators use duct tape to seal clothing).

Containment

The purpose of containment during remediation activities is to limit release of mold into the air and surroundings, in order to minimize the exposure of remediators and building occupants to mold. Mold and moldy debris should not be allowed to spread to areas in the building beyond the contaminated site.

Containment Tips

- Always maintain the containment area under negative pressure.
- Exhaust fans to outdoors and ensure that adequate makeup air is provided.
- If the containment is working, the polyethylene sheeting should billow inwards on all surfaces. If it flutters or billows outward, containment has been lost, and you should find and correct the problem before continuing your remediation activities.

The two types of containment recommended in Table 2 are limited and full. The larger the area of moldy material, the greater the possibility of human exposure and the greater the need for containment. In general, the size of the area helps determine the level of containment. However, a heavy growth of mold in a relatively small area could release more spores than a lighter growth of mold in a relatively large area. Choice of containment should be based on professional judgment.[10] The primary object of containment should be to prevent occupant and remediator exposure to mold.

[10] For example, a remediator may decide that a small area that is extensively contaminated and has the potential to distribute mold to occupied areas during cleanup should have full containment, whereas a large wall surface that is lightly contaminated and easily cleaned would require only limited containment.

Limited Containment

Limited containment is generally recommended for areas involving between 10 and 100 square feet (ft^2) of mold contamination. The enclosure around the moldy area should consist of a single layer of 6-mil, fire-retardant polyethylene sheeting. The containment should have a slit entry and covering flap on the outside of the containment area. For small areas, the polyethylene sheeting can be affixed to floors and ceilings with duct tape. For larger areas, a steel or wooden stud frame can be erected and polyethylene sheeting attached to it. All supply and air vents, doors, chases, and risers within the containment area must be sealed with polyethylene sheeting to minimize the migration of contaminants to other parts of the building. Heavy mold growth on ceiling tiles may impact HVAC systems if the space above the ceiling is used as a return air plenum. In this case, containment should be installed from the floor to the ceiling deck, and the filters in the air handling units serving the affected area may have to be replaced once remediation is finished.

Containment Area

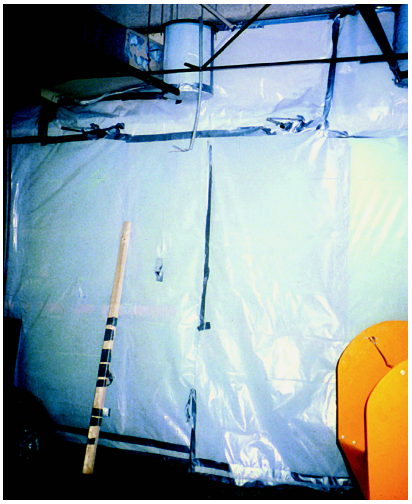

Photo 8: Full containment on large job

The containment area must be maintained under negative pressure relative to surrounding areas. This will ensure that contaminated air does not flow into adjacent areas. This can be done with a HEPA-filtered fan unit exhausted outside of the building. For small, easily contained areas, an exhaust fan ducted to the outdoors can also be used. The surfaces of all objects removed from the containment area should be remediated/cleaned prior to removal. The remediation guidelines outlined in Table 2 can be implemented when the containment is completely sealed and is under negative pressure relative to the surrounding area.

Full Containment

Full containment is recommended for the cleanup of mold-contaminated surface areas greater than 100 ft^2 or in any situation in which it appears likely that the occupant space would be further contaminated without full containment. Double layers of polyethylene should be used to create a barrier between the moldy area and other parts of the building. A decontamination chamber or airlock should be constructed for entry into and exit from the remediation area. The entryways to the airlock from the outside and from the airlock to the main containment area should consist of a slit entry with covering flaps on the outside surface of each slit entry. The chamber should be large enough to hold a waste container and allow a person to put on and remove PPE. All contaminated PPE, except respirators, should be placed in a sealed bag while in this chamber. Respirators should be worn until remediators are outside the decontamination chamber. PPE must be worn throughout the final stages of HEPA vacuuming and damp-wiping of the contained area. PPE must also be worn during HEPA vacuum filter changes or cleanup of the HEPA vacuum.

Equipment

Moisture Meters: Measure/ Monitor Moisture Levels in Building Materials

Moisture meters may be helpful for measuring the moisture content in a variety of building materials following water damage. They can also be used to monitor the process of drying damaged materials. These direct reading devices have a thin probe which can be inserted into the material to be tested or can be pressed directly against the surface of the material. Moisture meters can be used on materials such as carpet, wallboard, wood, brick, and concrete.

Moisture Meter

Photo 9: Moisture meter measuring moisture content of plywood subfloor

Humidity Gauges or Meters: Monitor Moisture Levels in the Air

Humidity meters can be used to monitor humidity indoors. Inexpensive (<$50) models are available that monitor both temperature and humidity.

Humidistat: Turns on HVAC System at Specific Relative Humidity (RH)

A humidistat is a control device that can be connected to the HVAC system and adjusted so that, if the humidity level rises above a set point, the HVAC system will automatically come on.

HVAC System Filter: Filters Outdoor Air

Use high-quality filters in your HVAC system during remediation. Consult an engineer for the appropriate efficiency for your specific HVAC system and consider upgrading your filters if appropriate. Conventional HVAC filters are typically not effective in filtering particles the size of mold spores. Consider upgrading to a filter with a minimum efficiency of 50 to 60% or a rating of MERV 8, as determined by Test Standard 52.2 of the American Society of Heating, Refrigerating, and Air Conditioning Engineers. Remember to change filters regularly and change them following any remediation activities.

Sampling

Is sampling for mold needed? In most cases, 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. Surface sampling may also be useful in order to determine if an area has been adequately cleaned or remediated. Sampling should be done only after developing a sampling plan that includes a confirmable theory regarding suspected mold sources and routes of exposure. Figure out what you think is happening and how to prove or disprove it before you sample!

If you do not have extensive experience and/or are in doubt about sampling, consult an experienced professional. This individual can help you decide if sampling for mold is useful and/or needed, and will be able to carry out any necessary sampling. It is important to remember that the results of sampling may have limited use or application. Sampling may help locate the source of 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. After remediation, the types and concentrations of mold in indoor air samples should be similar to what is found in the local outdoor air. Since no EPA or other Federal threshold limits have been set for mold or mold spores, sampling cannot be used to check a building's compliance with Federal mold standards.

Sampling for mold should be conducted by professionals with specific experience in designing mold sampling protocols, sampling methods, and interpretation of results. Sample analysis should follow analytical methods recommended by the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or other professional guidelines (see Resources List). Types of samples include air samples, surface samples, bulk samples (chunks of carpet, insulation, wall board, etc.), and water samples from condensate drain pans or cooling towers.

A number of pitfalls may be encountered when inexperienced personnel conduct sampling. They may take an inadequate number of samples, there may be inconsistency in sampling protocols, the samples may become contaminated, outdoor control samples may be omitted, and you may incur costs for unneeded or inappropriate samples. Budget constraints will often be a consideration when sampling; professional advice may be necessary to determine if it is possible to take sufficient samples to characterize a problem on a given budget. If it is not possible to sample properly, with a sufficient number of samples to answer the question(s) posed, it would be preferable not to sample. Inadequate sample plans may generate misleading, confusing, and useless results.

Keep in mind that air sampling for mold provides information only for the moment in time in which the sampling occurred, much like a snapshot. Air sampling will reveal, when properly done, what was in the air at the moment when the sample was taken. For someone without experience, sampling results will be difficult to interpret. Experience in interpretation of results is essential.

How Do You Know When You Have Finished Remediation/Cleanup?

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 moldy odors should not be present.
3. If you have sampled, the kinds and concentrations of mold and mold spores in the building should be similar to those found outside, once cleanup activities have been completed.
4. You should revisit the site(s) 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 health complaints or physical symptoms.
6. Ultimately, this is a judgment call; there is no easy answer.

CHECKLIST FOR MOLD REMEDIATION*

Investigate and evaluate moisture and mold problems

- ❑ Assess size of moldy area (square feet)
- ❑ Consider the possibility of hidden mold
- ❑ Clean up small mold problems and fix moisture problems before they become large problems
- ❑ Select remediation manager for medium or large size mold problem
- ❑ Investigate areas associated with occupant complaints
- ❑ Identify source(s) or cause of water or moisture problem(s)
- ❑ Note type of water-damaged materials (wallboard, carpet, etc.)
- ❑ Check inside air ducts and air handling unit
- ❑ Throughout process, consult qualified professional if necessary or desired

Communicate with building occupants at all stages of process, as appropriate

- ❑ Designate contact person for questions and comments about medium or large scale remediation as needed

Plan remediation

- ❑ Adapt or modify remediation guidelines to fit your situation; use professional judgment
- ❑ Plan to dry wet, non-moldy materials within 48 hours to prevent mold growth (see Table 1 and text)
- ❑ Select cleanup methods for moldy items (see Table 2 and text)
- ❑ Select Personal Protection Equipment – protect remediators (see Table 2 and text)
- ❑ Select containment equipment – protect building occupants (see Table 2 and text)
- ❑ Select remediation personnel who have the experience and training needed to implement the remediation plan and use Personal Protection Equipment and containment as appropriate

Remediate moisture and mold problems

- ❑ Fix moisture problem, implement repair plan and/or maintenance plan
- ❑ Dry wet, non-moldy materials within 48 hours to prevent mold growth
- ❑ Clean and dry moldy materials (see Table 2 and text)
- ❑ Discard moldy porous items that can't be cleaned (see Table 2 and text)

***** For details, see main text of this publication. Please note that this checklist was designed to highlight key parts of a school or commercial building remediation and does not list all potential steps or problems.

* See pocket on inside back cover for an additional copy of this checklist.

RESOURCES LIST – EPA

U.S. Environmental Protection Agency (EPA), Indoor Environments Division (IED)

An Office Building Occupant's Guide to IAQ
www.epa.gov/iaq/pubs/occupgd.html

Biological Contaminants
www.epa.gov/iaq/pubs/bio_1.html

Building Air Quality Action Plan (for Commercial Buildings)
www.epa.gov/iaq/base/actionpl.html

Floods / Flooding
www.epa.gov/iaq/pubs/flood.html

Indoor Air Quality (IAQ) Home Page
www.epa.gov/iaq

IAQ in Large Buildings / Commercial Buildings
www.epa.gov/iaq/base/index.html

IAQ in Schools
www.epa.gov/iaq/schools/index.html

Mold Remediation in Schools and Commercial Buildings
www.epa.gov/iaq/pubs/molds.html

Mold Resources
www.epa.gov/iaq/pubs/moldresources.html

U.S. EPA IAQ Information Clearinghouse

Phone: (800) 438-4318 or (703) 356-4020
Fax: (703) 821-8236
Email: iaqinfo@aol.com

Indoor air-related documents, answers to Indoor Air Quality (IAQ) questions, maintains listing of state IAQ contacts, and regional EPA contacts

Asthma and Allergic Diseases:

American Academy of Allergy, Asthma & Immunology (AAAAI)
(800) 822-2762 www.aaaai.org
Physician referral directory, information on allergies and asthma

Asthma and Allergy Foundation of America (AAFA)
(800) 7-ASTHMA (800-727-8462) www.aafa.org
Information on allergies and asthma

American Lung Association (ALA)
(800) LUNG-USA (800-586-4872) www.lungusa.org
Information on allergies and asthma

Asthma and Allergy Network/Mothers of Asthmatics, Inc. (AAN-MA)
(800) 878-4403 or (703) 641-9595 www.aanma.org
Information on allergies and asthma

National Institute of Allergy and Infectious Diseases (NIAID)
(301) 496-5717 www.niaid.nih.gov
Information on allergies and asthma

National Jewish Medical and Research Center
(800) 222-LUNG (800-222-5864) www.njc.org
Information on allergies and asthma

Canada Mortgage and Housing Corporation (CMHC)
(613) 748-2003 [International] www.cmhc-schl.gc.ca/cmhc.html
Several documents on mold-related topics available

Carpet and Rug Institute (CRI)
(800) 882-8846 www.carpet-rug.com
Carpet maintenance, restoration guidelines for water-damaged carpet, other carpet-related issues.

Centers for Disease Control and Prevention (CDC)
(800) 311-3435 www.cdc.gov
Information on health-related topics including asthma, molds in the environment, and occupational health

CDC's National Center for Environmental Health (NCEH)
(888) 232-6789 www.cdc.gov/nceh/asthma/factsheets/molds/default.htm
"Questions and answers on *Stachybotrys chartarum* and other molds"

RESOURCES LIST – OTHER

The following list of resources includes information created and maintained by other public and private organizations. The U.S. EPA does not control or guarantee the accuracy, relevance, timeliness, or completeness of this outside information. Further, the inclusion of such resources is not intended to endorse any views expressed or products or services offered by the author of the reference or the organization operating the service on which the reference is maintained.

American College of Occupational and Environmental Medicine (ACOEM)
(847) 818-1800 www.siouxland.com/acoem/
Referrals to physicians who have experience with environmental exposures

American Conference of Governmental Industrial Hygienists, Inc. (ACGIH)
(513) 742-2020 www.acgih.org
Occupational and environmental health and safety information

American Industrial Hygiene Association (AIHA)
(703) 849-8888 www.aiha.org
Information on industrial hygiene and indoor air quality issues including mold hazards and legal issues

American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE)
(800) 527-4723 www.ashrae.org
Information on engineering issues and indoor air quality

Association of Occupational and Environmental Clinics (AOEC)
(202) 347-4976 www.aoec.org
Referrals to clinics with physicians who have experience with environmental exposures, including exposures to mold; maintains a database of occupational and environmental cases

Association of Specialists in Cleaning and Restoration (ASCR)
(800) 272-7012 www.ascr.org
Disaster recovery, water and fire damage, emergency tips, referrals to professionals

Energy and Environmental Building Association
(952) 881-1098 www.eeba.org
Information on energy-efficient and environmentally responsible buildings, humidity/moisture control/vapor barriers

Floods/Flooding:

Federal Emergency Management Agency (FEMA)
(800) 480-2520 www.fema.gov/mit
Publications on floods, flood proofing, etc.

University of Minnesota, Department of Environmental Health & Safety
(612) 626-5804 www.dehs.umn.edu/remanagi.html
Managing water infiltration into buildings

University of Wisconsin-Extension, The Disaster Handbook
(608) 262-3980 www.uwex.edu/ces/news/handbook.html
Information on floods and other natural disasters

Health Canada, Health Protection Branch, Laboratory Centre for Disease Control, Office of Biosafety
(613) 957-1779 www.hc-sc.gc.ca/main/lcdc/web/biosafty/msds/index.html
Material Safety Data Sheets with health and safety information on infectious microorganisms, including *Aspergillus* and other molds and airborne biologicals

Indoor Environmental Remediation Board (IERB)
(215) 387-4097 www.ierb.org
Information on best practices in building remediation

Institute of Inspection, Cleaning and Restoration Certification (IICRC)
(360) 693-5675 www.iicrc.org
Information on and standards for the inspection, cleaning, and restoration industry

International Sanitary Supply Association (ISSA)
(800) 225-4772 www.issa.com
Education and training on cleaning and maintenance

International Society of Cleaning Technicians (ISCT)
(800) WHY-ISCT (800-949-4728) www.isct.com
Information on cleaning such as stain removal guide for carpets

Material Safety Data Sheets (MSDSs) - Cornell University
http://msds.pdc.cornell.edu/msdssrch.asp
MSDSs contain information on chemicals or compounds including topics such as health effects, first aid, and protective equipment for people who work with or handle these chemicals

MidAtlantic Environmental Hygiene Resource Center (MEHRC)
(215) 387-4096 www.mehrc.org
Indoor environmental quality training on including topics such as mold remediation

National Air Duct Cleaners Association (NADCA)
(202) 737-2926 www.nadca.com
Duct cleaning information

National Antimicrobial Information Network (NAIN)
(800) 447-6349 http://ace.orst.edu/info/nain/
Regulatory information, safety information, and product information on antimicrobials

National Association of the Remodeling Industry (NARI)
(847) 298-9200 www.nari.org
Consumer information on remodeling, including help finding a professional remodeling contractor

National Institute of Building Sciences (NIBS)
(202) 289-7800 http://nibs.org
Information on building regulations, science, and technology

National Institute for Occupational Safety and Health (NIOSH)
(800) 35-NIOSH (800-356-4674) www.cdc.gov/niosh
Health and safety information with a workplace orientation

National Pesticide Telecommunications Network (NPTN)
(800) 858-7378 http://ace.orst.edu/info/nptn
Information on pesticides/antimicrobial chemicals, including safety and disposal information

New York City Department of Health,
Bureau of Environmental & Occupational Disease Epidemiology
(212) 788-4290 www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html
"Guidelines on Assessment and Remediation of Fungi in Indoor Environments"

Occupational Safety & Health Administration (OSHA)
(800) 321-OSHA (800-321-6742) www.osha.gov
Information on worker safety, includes topics such as respirator use and safety in the workplace

Sheet Metal & Air Conditioning Contractors' National Association (SMACNA)
(703) 803-2980 www.smacna.org
Technical information on topics such as air conditioning and air ducts

Smithsonian Center for Materials Research and Education (SCMRE)
(301) 238-3700 www.si.edu/scmre
Guidelines for caring for and preserving furniture and wooden objects, paper-based materials; preservation studies

University of Michigan Herbarium
(734) 764-2407 www.herb.lsa.umich.edu
Specimen-based information on fungi; information on fungal ecology

University of Tulsa Indoor Air Program
(918) 631-5246 www.utulsa.edu/iaqprogram
Courses, classes, and continuing education on indoor air quality

Water Loss Institute, Association of Specialists in Cleaning and Restoration
(800) 272-7012 or (410) 729-9900 www.ascr.org/wli.asp
Information on water and sewage damage restoration

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APPENDIX A – GLOSSARY

Allergen ..... Substance (such as mold) that can cause an allergic reaction.

APR ..... Air purifying respirator

Biocide ..... Substance or chemical that kills organisms such as molds.

EPA ..... Environmental Protection Agency

Fungi ..... Fungi are neither animals nor plants and are classified in a kingdom of their own. Fungi include molds, yeasts, mushrooms, and puffballs. In this document, the terms fungi and mold are used interchangeably. Molds reproduce by making spores. Mold spores waft through the indoor and outdoor air continually. When mold spores land on a damp spot indoors, they may begin growing and digesting whatever they are growing on. Molds can grow on virtually any organic substance, providing moisture and oxygen are present. It is estimated that more than 1.5 million species of fungi exist.

Fungicide ..... Substance or chemical that kills fungi.

HEPA ..... High-Efficiency Particulate Air

Hypersensitivity ..... Great or excessive sensitivity

IAQ ..... Indoor Air Quality

Mold ..... Molds are a group of organisms that belong to the kingdom Fungi. In this document, the terms fungi and mold are used interchangeably. There are over 20,000 species of mold.

mVOC	Microbial volatile organic compound, a chemical made by a mold which may have a moldy or musty odor.
OSHA	Occupational Safety and Health Administration
PAPR	Powered air purifying respirator
PPE	Personal Protective Equipment
Remediate	Fix
Sensitization	Repeated or single exposure to an allergen that results in the exposed individual becoming hypersensitive to the allergen.
Spore	Molds reproduce by means of spores. Spores are microscopic; they vary in shape and size (2-100 micrometers). Spores may travel in several ways—they may be passively moved (by a breeze or waterdrop), mechanically disturbed (by a person or animal passing by), or actively discharged by the mold (usually under moist conditions or high humidity).

APPENDIX B – INTRODUCTION TO MOLDS

Molds in the Environment

Molds live in the soil, on plants, and on dead or decaying matter. Outdoors, molds play a key role in the breakdown of leaves, wood, and other plant debris. Molds belong to the kingdom Fungi, and unlike plants, they lack chlorophyll and must survive by digesting plant materials, using plant and other organic materials for food. Without molds, our environment would be overwhelmed with large amounts of dead plant matter.

Molds produce tiny spores to reproduce, just as some plants produce seeds. These mold spores can be found in both indoor and outdoor air, and settled on indoor and outdoor surfaces. When mold spores land on a damp spot, they may begin growing and digesting whatever they are growing on in order to survive. Since molds gradually destroy the things they grow on, you can prevent damage to building materials and furnishings and save money by eliminating mold growth.

Moisture control is the key to mold control. Molds need both food and water to survive; since molds can digest most things, water is the factor that limits mold growth. Molds will often grow in damp or wet areas indoors. Common sites for indoor mold growth include bathroom tile, basement walls, areas around windows where moisture condenses, and near leaky water fountains or sinks. Common sources or causes of water or moisture problems include roof leaks, deferred maintenance, condensation associated with high humidity or cold spots in the building, localized flooding due to plumbing failures or heavy rains, slow leaks in plumbing fixtures, and malfunction or poor design of humidification systems. Uncontrolled humidity can also be a source of moisture leading to mold growth, particularly in hot, humid climates.

Health Effects and Symptoms Associated with Mold Exposure

When moisture problems occur and mold growth results, building occupants may begin to report odors and a variety of health problems, such as headaches, breathing difficulties, skin irritation, allergic reactions, and aggravation of asthma symptoms; all of these symptoms could potentially be associated with mold exposure.

Potential Health Effects Associated with Inhalation Exposure to Molds and Mycotoxins

- Allergic Reactions (e.g., rhinitis and dermatitis or skin rash)
- Asthma
- Hypersensitivity Pneumonitis
- Other Immunologic Effects

Research on mold and health effects is ongoing. This list is not intended to be all-inclusive.

The health effects listed above are well documented in humans. Evidence for other health effects in humans is less substantial and is primarily based on case reports or occupational studies.

All molds have the potential to cause health effects. Molds produce allergens, irritants, and in some cases, toxins that may cause reactions in humans. The types and severity of symptoms depend, in part, on the types of mold present, the extent of an individual's exposure, the ages of the individuals, and their existing sensitivities or allergies. Specific reactions to mold growth can include the following:

Allergic Reactions: Inhaling or touching mold or mold spores may cause allergic reactions in sensitive individuals. Allergic reactions to mold are common – these reactions can be immediate or delayed. Allergic responses include hay fever-type symptoms, such as sneezing, runny nose, red eyes, and skin rash (dermatitis). Mold spores and fragments can produce allergic reactions in sensitive individuals regardless of whether the mold is dead or alive. Repeated or single exposure to mold or mold spores may cause previously non-sensitive individuals to become sensitive. Repeated exposure has the potential to increase sensitivity.

Asthma: Molds can trigger asthma attacks in persons who are allergic (sensitized) to molds. The irritants produced by molds may also worsen asthma in non-allergic (non-sensitized) people.

Hypersensitivity Pneumonitis: Hypersensitivity pneumonitis may develop following either short-term (acute) or long-term (chronic) exposure to molds. The disease resembles bacterial pneumonia and is uncommon.

Irritant Effects: Mold exposure can cause irritation of the eyes, skin, nose, throat, and lungs, and sometimes can create a burning sensation in these areas.

Opportunistic Infections: People with weakened immune systems (i.e., immune-compromised or immune-suppressed individuals) may be more vulnerable to infections by molds (as well as more vulnerable than healthy persons to mold toxins). *Aspergillus fumigatus,* for example, has been known to infect the lungs of immune-compromised individuals. These individuals inhale the mold spores which then start growing in their lungs. *Trichoderma* has also been known to infect immune-compromised children.

Healthy individuals are usually not vulnerable to opportunistic infections from airborne mold exposure. However, molds can cause common skin diseases, such as athlete's foot, as well as other infections such as yeast infections.

Mold Toxins (Mycotoxins)

Molds can produce toxic substances called mycotoxins. Some mycotoxins cling to the surface of mold spores; others may be found within spores. More than 200 mycotoxins have been identified from common molds, and many more remain to be identified. Some of the molds that are known to produce mycotoxins are commonly found in moisture-damaged buildings. Exposure pathways for mycotoxins can include inhalation, ingestion, or skin contact. Although some mycotoxins are well known to affect humans and have been shown to be responsible for human health effects, for many mycotoxins, little information is available.

Aflatoxin B_1 is perhaps the most well known and studied mycotoxin. It can be produced by the molds *Aspergillus flavus* and *Aspergillus parasiticus* and is one of the most potent carcinogens known. Ingestion of aflatoxin B_1 can cause liver cancer. There is also some evidence that inhalation of aflatoxin B_1 can cause lung cancer. Aflatoxin B_1 has been found on contaminated grains, peanuts, and other human and animal foodstuffs. However, *Aspergillus flavus* and *Aspergillus parasiticus* are *not* commonly found on building materials or in indoor environments.

Toxic Molds

Some molds, such as *Aspergillus versicolor* and *Stachybotrys atra (chartarum)*, are known to produce potent toxins under certain circumstances. Although some mycotoxins are well known to affect humans and have been shown to be responsible for human health effects, for many mycotoxins, little information is available, and in some cases research is ongoing. For example, some strains of *Stachybotrys atra* can produce one or more potent toxins. In addition, preliminary reports from an investigation of an outbreak of pulomonary hemorrhage in infants suggested an association between pulmonary hemorrhage and exposure to *Stachybotrys chartarum*. Review of the evidence of this association at CDC resulted in a published clarification stating that such an association was not established. Research on the possible causes of pulumonary hemorrhage in infants continues. Consult the Centers for Disease Control and Prevention (CDC) for more information on pulmonary hemorrhage in infants (see Resources List, page 31, for CDC contact and other information).

Much of the information on the human health effects of inhalation exposure to mycotoxins comes from studies done in the workplace and some case studies or case reports.* Many symptoms and human health effects attributed to inhalation of mycotoxins have been reported including: mucous membrane irritation, skin rash, nausea, immune system suppression, acute or chronic liver damage, acute or chronic central nervous system damage, endocrine effects, and cancer. More studies are needed to get a clear picture of the health effects related to most mycotoxins. However, it is clearly prudent to avoid exposure to molds and mycotoxins.

Some molds can produce several toxins, and some molds produce mycotoxins only under certain environmental conditions. The presence of mold in a building does not necessarily mean that mycotoxins are present or that they are present in large quantities.

* Information on ingestion exposure, for both humans and animals, is more abundant—a wide range of health effects has been reported following ingestion of moldy foods including liver damage, nervous system damage, and immunological effects.

Microbial Volatile Organic Compounds (mVOCs)

Some compounds produced by molds are volatile and are released directly into the air. These are known as microbial volatile organic compounds (mVOCs). Because these compounds often have strong and/or unpleasant odors, they can be the source of odors associated with molds. Exposure to mVOCs from molds has been linked to symptoms such as headaches, nasal irritation, dizziness, fatigue, and nausea. Research on MVOCs is still in the early phase.

Glucans or Fungal Cell Wall Components (also known as ß-(1 3)-D-Glucans)

Glucans are small pieces of the cell walls of molds which may cause inflammatory lung and airway reactions. These glucans can affect the immune system when inhaled. Exposure to very high levels of glucans or dust mixtures including glucans may cause a flu-like illness known as Organic Dust Toxic Syndrome (ODTS). This illness has been primarily noted in agricultural and manufacturing settings.

Spores

Mold spores are microscopic (2-10 *u*m) and are naturally present in both indoor and outdoor air. Molds reproduce by means of spores. Some molds have spores that are easily disturbed and waft into the air and settle repeatedly with each disturbance. Other molds have sticky spores that will cling to surfaces and are dislodged by brushing against them or by other direct contact. Spores may remain able to grow for years after they are produced. In addition, whether or not the spores are alive, the allergens in and on them may remain allergenic for years.

APPENDIX C – COMMUNICATION WITH BUILDING OCCUPANTS

Communication with building occupants is essential for successful mold remediation. Some occupants will naturally be concerned about mold growth in their building and the potential health impacts. Occupants' perceptions of the health risk may rise if they perceive that information is being withheld from them. The status of the building investigation and remediation should be openly communicated including information on any known or suspected health risks.

Small remediation efforts will usually not require a formal communication process, but do be sure to take individual concerns seriously and use common sense when deciding whether formal communications are required. Individuals managing medium or large remediation efforts should make sure they understand and address the concerns of building occupants and communicate clearly what has to be done as well as possible health concerns.

Mold in Schools

Special communication strategies may be desirable if you are treating a mold problem in a school. Teachers, parents, and other locally affected groups should be notified of significant issues as soon as they are identified. Consider holding a special meeting to provide parents with an opportunity to learn about the problem and ask questions of school authorities, particularly if it is necessary/advisable to ensure that the school is vacated during remediation. For more information on investigating and remediating molds in schools, refer to the U.S. EPA's *IAQ Tools for Schools* kit and the asthma companion piece for the IAQ Tools for Schools kit, entitled *Managing Asthma in the School Environment*.

Communication approaches include regular memos and/or meetings with occupants (with time allotted for questions and answers), depending on the scope of the remediation and the level of occupant interest. Tell the occupants about the size of the project, planned activities, and remediation timetable. Send or post regular updates on the remediation progress, and send or post a final memo when the project is completed or hold a final meeting. Try and resolve

Communicate, When You Remediate

- Establish that the health and safety of building occupants are top priorities.
- Demonstrate that the occupants' concerns are understood and taken seriously.
- Present clearly the current status of the investigation or remediation efforts.
- Identify a person whom building occupants can contact directly to discuss questions and comments about the remediation activities.

issues and occupant concerns as they come up. When building-wide communications are frequent and open, those managing the remediation can direct more time toward resolving the problem and less time to responding to occupant concerns.

If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected. Communication is important if occupants are relocated during remediation. The decision to relocate occupants should consider the size of the area affected, the extent and types of health effects exhibited by the occupants, and the potential health risks associated with debris and activities during the remediation project. When considering the issue of relocation, be sure to inquire about, accommodate, and plan for individuals with asthma, allergies, compromised immune systems, and other health-related concerns. Smooth the relocation process and give occupants an opportunity to participate in resolution of the problem by clearly explaining the disruption of the workplace and work schedules. Notify individuals of relocation efforts in advance, if possible.

INDEX

NOTES

CHECKLIST FOR MOLD REMEDIATION*

Investigate and evaluate moisture and mold problems

- ❑ Assess size of moldy area (square feet)
- ❑ Consider the possibility of hidden mold
- ❑ Clean up small mold problems and fix moisture problems before they become large problems
- ❑ Select remediation manager for medium or large size mold problem
- ❑ Investigate areas associated with occupant complaints
- ❑ Identify source(s) or cause of water or moisture problem(s)
- ❑ Note type of water-damaged materials (wallboard, carpet, etc.)
- ❑ Check inside air ducts and air handling unit
- ❑ Throughout process, consult qualified professional if necessary or desired

Communicate with building occupants at all stages of process, as appropriate

- ❑ Designate contact person for questions and comments about medium or large scale remediation as needed

Plan remediation

- ❑ Adapt or modify remediation guidelines to fit your situation; use professional judgment
- ❑ Plan to dry wet, non-moldy materials within 48 hours to prevent mold growth (see Table 1 and text)
- ❑ Select cleanup methods for moldy items (see Table 2 and text)
- ❑ Select Personal Protective Equipment – protect remediators (see Table 2 and text)
- ❑ Select containment equipment – protect building occupants (see Table 2 and text)
- ❑ Select remediation personnel who have the experience and training needed to implement the remediation plan and use Personal Protective Equipment and containment as appropriate

Remediate moisture and mold problems

- ❑ Fix moisture problem, implement repair plan and/or maintenance plan
- ❑ Dry wet, non-moldy materials within 48 hours to prevent mold growth
- ❑ Clean and dry moldy materials (see Table 2 and text)
- ❑ Discard moldy porous items that can't be cleaned (see Table 2 and text)

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* For details, see text (of *Mold Remediation in Schools and Commercial Buildings*). Please note that this checklist was designed to highlight key parts of a school or commercial building remediation and does not list all potential steps or problems.

Questions to Consider Before Remediating

- Are there existing moisture problems in the building?
- Have building materials been wet more than 48 hours? (See Table 2 & text.)
- Are there hidden sources of water or is the humidity too high (high enough to cause condensation)?
- Are building occupants reporting musty or moldy odors?
- Are building occupants reporting health problems?
- Are building materials or furnishings visibly damaged?
- Has maintenance been delayed or the maintenance plan been altered?
- Has the building been recently remodeled or has building use changed?
- Is consultation with medical or health professionals indicated?

Avoid Exposure to and Contact with Mold

- Use Personal Protective Equipment (PPE)

U.S. Environmental Protection Agency (EPA)

- Indoor Air Quality Information Clearinghouse
  (800) 438-4318 www.epa.gov/iaq

How Healthy Is The Air In Your Home?

A Room–by–Room Checklist for Your Home's Indoor Air

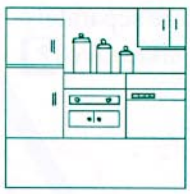
CONSUMER RESEARCH COUNCIL

To live more safely and stay healthy, we often take simple steps to protect ourselves and our families. Smoke detectors alert us about the potential for fire. Parents childproof their homes to protect their inquisitive toddlers. Yet, few of us recognize that the air we breathe inside our homes can make us feel tired or dizzy, make our eyes itch or our throats feel scratchy, bring on an asthma attack, spread an infectious disease, or even, over a long period of time, contribute to our risk of cancer.

You may be surprised to learn that the air inside your home may be more seriously polluted than the outdoor air, even if you live in a large industrial city. This, coupled with the fact that you spend a large amount of time inside your home, makes indoor air quality a health concern. Some people, such as the young, the elderly, and the chronically ill, are even more seriously affected. Fortunately, there are simple steps you can take to reduce your exposure to indoor pollutants.

How To Use This Checklist

Use the following room-by-room guide to check for indoor pollutants. In each room, we have listed different household products, the indoor air problems associated with them, and remedies intended to help decrease your family's exposure to indoor pollutants. A summary of adverse health effects or symptoms associated with different pollutants is also included. This information is not intended to replace the services, advice, or consultation of a physician.



KITCHEN

Household Cleaners. *Remedy:* Open window. Use according to manufacturer's directions. *See* O

Moisture from Cooking & Dishwasher Use. *Remedy:* Install and use exhaust fan. *See* B

Pressed-Wood Cabinets. *Remedy: See Living Room: Paneling, Pressed-Wood, Cabinetry. See* F

Unvented Gas Stove & Range. *Remedy:* Keep burners properly adjusted (blue flame tip, not yellow). Install and use exhaust fan. Never use a gas stove to heat your home. *See* CO CB

BATHROOM

Air Freshener. *Remedy:* Open window or use exhaust fan instead. If using air fresheners, follow directions. *See* O

Moisture, Mold & Mildew. *Remedy:* Install and use exhaust fan. Fix plumbing leaks promptly. *See* B

Personal Care Products (e.g. hair spray, nail polish). *Remedy:* Open window or use exhaust fan. Follow directions for use. *See* O

BEDROOM

Dry Cleaned Goods. *Remedy:* Do not accept dry cleaned goods with chemical odor until they have been properly dried. Try a different dry cleaner. *See* O

Humidifier. *Remedy:* Clean according to manufacturer's directions. Refill with clean water daily. *See* B

Moth Repellents (with paradichlorobenzene). *Remedy:* Avoid breathing vapors. Place moth repellents in trunks or other containers and store separately (attic, storage closet), away from living areas. *See* P

LIVING ROOM

Paneling, Pressed-Wood Furniture & Cabinetry. *Remedy:* When purchasing new paneling,

pressed-wood furniture or cabinetry, ask about formaldehyde content and release. Some types of pressed-wood products, such as those with phenol resin, emit less formaldehyde. Also, pressed-wood products coated with polyurethane or laminates may reduce formaldehyde emissions. After installation, open windows. Maintain moderate temperature and humidity. *See* F

ALL ROOMS

Animals (dander; hair, feather, or skin). *Remedy:* Clean house regularly. *See* B

Carpets. *Remedy:* Clean and dry or remove water-damaged carpets promptly. If installing new carpet, ask your retailer to air out the carpet before installation. Ask for low-emitting adhesives, if adhesives are needed. Leave the premises during and after installation. Open doors and windows; use window fans or room air conditioners. Vacuum regularly. *See* B resulting from water damage; O from new carpet.

Draperies. *Remedy:* New draperies may be treated with a formaldehyde-based finish and may emit formaldehyde for a short time. Open doors and windows. Maintain moderate temperature and humidity. *See* F

Health Effects of Common Indoor Pollutants

A **ASBESTOS:** No immediate symptoms, but long term risk of chest and abdominal cancers and lung diseases. Smokers are at higher risk of developing asbestos-induced lung cancer.

B **BIOLOGICALS:** Includes allergens (mold, mildew, pollen) and infectious disease agents (viruses, bacteria). Eye, nose, and throat irritation; shortness of breath; dizziness; drowsiness; fever; digestive problems; asthma; humidifier fever (a respiratory illness); influenza and other infectious diseases.

CO **CARBON MONOXIDE:** At low concentrations, fatigue in healthy people and chest pain in people with heart disease. At higher concentrations, impaired vision and coordination; headaches; dizziness; confusion; nausea; flu-like symptoms that clear up after leaving home; and death. Hundreds of people die each year in their homes from CO poisonings.

CB **COMBUSTION BYPRODUCTS:** Eye, nose, and throat irritation. Nitrogen dioxide may cause decreased lung function and increased respiratory infections in young children. Respirable particles may cause respiratory infections, bronchitis, and lung cancer (*See Environmental Tobacco Smoke*).

E **ENVIRONMENTAL TOBACCO SMOKE:** Eye, nose, and throat irritation; headaches; lung cancer; may contribute to heart disease. Specifically for children, increased risk of lower respiratory tract infections (bronchitis, pneumonia) and ear infections; increased severity and frequency of asthma episodes; decreased lung function.

F **FORMALDEHYDE:** A widely used chemical in household products. Eye, nose, and throat irritation; wheezing and coughing; fatigue; skin rash; severe allergic reactions. May cause cancer. May also cause other effects listed under *Organic Gases*.

L **LEAD:** Lead affects practically all systems within the body. Lower levels of lead can adversely affect the central nervous system, kidney, and blood cells and can impair mental and physical development. Lead at high levels can cause convulsions, coma, and even death.

O **ORGANIC GASES:** Gases released from chemicals used in household products. Eye, nose, and throat irritation; headaches; loss of coordination; nausea; damage to liver, kidney, and central nervous system. Some organic chemicals may cause cancer in humans.

P **PESTICIDES:** Eye, nose, and throat irritation; damage to central nervous system and kidney; increased risk of cancer.

R **RADON:** An invisible, radioactive gas. It is the second leading cause of lung cancer. No immediate symptoms. Smokers are at higher risk.

Environmental Tobacco Smoke (from cigarette, pipe, and cigar smoking). *Remedy:* Do not smoke in your home or permit others to do so (especially near children). If smoking cannot be avoided, open windows or use exhaust fans. *See* E CO CB

Floor Tiles Containing Asbestos. *Remedy:* Periodically inspect for damage or deterioration. Do not cut, rip, sand, or remove any asbestos-containing materials. If you plan to make changes that might disturb the asbestos, or if materials are more than slightly damaged, repair or removal by a professional is needed. Call EPA at 202–554–1404 for more information. *See* A

House Dust Mites. *Remedy:* Clean house and vacuum regularly. Wash bedding in hot water. *See* B

Lead-Based Paint (if manufactured before 1978). *Remedy:* Leave lead-based paint undisturbed if it is in good condition. Do not sand, burn off, or remove lead paint yourself; to remove, hire a person with special training for correcting lead paint problems. For more information call 1–800–LEAD–FYI. *See* L

Moisture. *Remedy:* Use exhaust fans. Use dehumidifier if necessary (*See Basement: Dehumidifier*). *See* B

GARAGE

Car Exhaust. *Remedy:* Do not idle car in garage. To keep exhaust out of house, use weather stripping on door from garage to house. *See* CO CB

Paint Supplies. *Remedy:* Open windows when using. Follow manufacturer's directions. Buy limited quantities. If products contain methylene chloride (e.g. paint strippers), use outdoors. Reseal containers well. Clean brushes and other materials outside. *See* O

Pesticides (products that kill household pests). *Remedy:* Use nonchemical methods of pest control where possible. Follow manufacturer's directions. Mix or dilute outdoors. Open windows when using indoors. Take plants or pets outside when applying pesticides. Do not store pesticides inside home. Clean shoes and hands to avoid tracking pesticides indoors. Call EPA at 1–800–858–PEST for more information. *See* P

Stored Fuels (e.g. gasoline, kerosene). *Remedy:* Buy limited quantities. Use well-sealed containers. Do not store inside home. *See* O

BASEMENT OR GROUND FLOOR

Asbestos Pipe Wrap & Furnace Insulation. *Remedy: See All Rooms: Floor Tiles Containing Asbestos. See* A

Dehumidifier. *Remedy:* Empty and clean water tray often. *See* B

Ground Moisture. *Remedy:* Clean and disinfect basement floor drain regularly. Keep basement dry and free of moisture and mildew. *See* B

Radon. *Remedy:* Test your home for radon—do it yourself kits are easy and inexpensive. Fix your home if your radon level is 4 picocuries per liter (pCi/L) or higher. For more information, contact your state radon office or call 1–800–SOS–RADON. *See* R

Stored Hobby Products (e.g. paint, glue, epoxy). *Remedy:* Follow manufacturer's directions. Use outdoors, if possible. Indoors, open window or use exhaust fan. Reseal containers well. Clean brushes and other materials outside. *See* O

Unvented Clothes Dryer. *Remedy:* Vent to outdoors. *See* B; CB, if gas-fired dryer.

HEATING & COOLING SYSTEMS

Air Conditioner. *Remedy:* Empty and clean water tray often. Follow all service and maintenance procedures, including changing filter. *See* B

Furnace. *Remedy:* Have your heating system inspected and serviced every year. Repair fuel or gas leaks promptly. Follow service and maintenance guidance, including changing filter. *See* CO CB

Fireplace. *Remedy:* Open flue when fireplace is in use. Have flue and chimney inspected annually for blocks, leaks, or other damage. *See* CO CB

Gas Space Heater. *Remedy:* In room where heater is located: open a door to the rest of the house; turn on exhaust fan; and open a window slightly. *See* CO CB

Kerosene Heater. *Remedy:* Vent to outside. Only use fuel recommended by manufacturer. Refill outside. If using unvented, open a door to the rest of the house and open a window slightly. *See* CO CB

Woodstove. *Remedy:* Vent to outside. Choose a properly sized woodstove that is certified to meet EPA emission standards. Make certain all woodstove doors fit tightly. Use aged or cured (dried) wood only; never use pressure-treated wood. Follow manufacturer's directions. *See* CO CB

For more information on reducing indoor air problems in the home, contact: Indoor Air Quality Information Clearinghouse at **1–800–438–4318**. Ask for a free copy of *The Inside Story: A Guide to Indoor Air Quality.* Operators are also able to answer questions and supply more information about specific indoor pollutants found in your home.

Funding for this document was provided through a cooperative agreement with the U.S. Environmental Protection Agency.

March 10, 2000 / 49(09);180-4

Update: Pulmonary Hemorrhage/Hemosiderosis Among Infants --- Cleveland, Ohio, 1993-1996

Please note: *An erratum has been published for this article. To view the erratum, please click here.*

A review within CDC and by outside experts of an investigation of acute pulmonary hemorrhage/hemosiderosis in infants has identified shortcomings in the implementation and reporting of the investigation described in *MMWR* (*1*,*2*) and detailed in other scientific publications authored, in part, by CDC personnel (*3*-*5*). The reviews led CDC to conclude that a possible association between acute pulmonary hemorrhage/hemosiderosis in infants and exposure to molds, specifically *Stachybotrys chartarum*, commonly referred to by its synonym *Stachybotrys atra*, was not proven. This report describes the specific findings of these internal and external reviews.

Background

In December 1994 and January 1997, articles in *MMWR* described a cluster of 10* infants from Cleveland, Ohio, with acute idiopathic pulmonary hemorrhage, also referred to as pulmonary hemosiderosis (*1*,*2*). The children resided in seven contiguous postal tracts and had had one or more hemorrhagic episodes, resulting in one death, during January 1993-December 1994. Preliminary results of a CDC case-control study (*2*) indicated that hemorrhage was associated with 1) major household water damage during the 6 months before illness and 2) increased levels of measurable household fungi, including the toxin-producing mold *S. chartarum* (syn. *S. atra*).

These findings and the observation that tricothecene mycotoxins were produced in the laboratory by some *S. chartarum* isolates recovered from the homes of study subjects have been published and referenced in peer-reviewed scientific literature (*3*-*9*). The hypothesis from the findings of the investigation was that infant pulmonary hemorrhage may be caused by exposure to potent mycotoxins produced by *S. chartarum* or other fungi growing in moist household environments (*4*,*5*). The findings also were cited in environmental health guidelines (*10*,*11*), congressional testimony (*12*), and the popular media (*13*-*16*), and have been debated among industrial hygienists and other occupational and environmental health scientists (*17*-*21*). Despite caution that "further research is needed to determine...causal[*ity*] (*4*)," the findings have influenced closure of public buildings, cleanup and remediation, and litigation (*16*,*22*-*28*).

In June 1997, a CDC scientific task force, in a review of the agency's response to the problem, advised the CDC director that concerns about the role of *S. chartarum* in pulmonary hemorrhage needed to be

addressed. In response, CDC convened a multidisciplinary internal group of senior scientists (working group) and sought the individual opinions of outside experts. The working group and the outside experts conducted separate reviews of the Cleveland investigation. The working group reviewed background literature, internal CDC documents, and published CDC reports; examined the data set; and interviewed the principal investigators. The external experts reviewed relevant literature, including internal CDC documents and the working group report, and invited additional consultants to address specific topics. The working group and the external consultants each concluded that further work is needed to better describe the clinical problem, its public health impact, and the factors that put infants at risk (*29*,*30*).

Case Identification

The reviewers had concerns about the characterization of the clinical problem as "hemosiderosis." The acute presentation in all 10 cases, the narrow age distribution (6 weeks to 6 months), and the absence of iron deficiency suggest that the illness described in the cluster of cases in Cleveland (*1*,*3*) is clinically distinct from idiopathic pulmonary hemosiderosis (IPH), the condition to which this cluster was linked (*31*). Hemosiderosis (i.e., hemosiderin-laden macrophages in the interstitium and alveolar spaces of the lung) is a pathologic finding indicative of pulmonary bleeding of any type, not a unique characteristic of a specific disease, etiology, or pathophysiologic process (*32*,*33*). Therefore, in referring to the cluster of cases in Cleveland, the working group defined that cluster as AIPH in infants. From the limited clinical and historic information available to the reviewers on cases added to the Cleveland series since the original cluster (D. Dearborn, Case Western Reserve Department of Pediatrics, personal communication, September 1999), the external consultants concluded that some of these additional cases (*6*), including several identified in a retrospective review of sudden infant death syndrome cases (*2*), do not conform to the clinical patterns of cases in the original cluster. Both groups of reviewers recognized limitations that precluded drawing conclusions about clinical or etiologic ties to IPH.

Association of Household AIPH with Water Damage and Fungi

Both groups of reviewers concluded that the available evidence does not substantiate the reported epidemiologic associations---between household water damage and AIPH (*3*) or between household fungi and AIPH (*4*)---or any inferences regarding causality. The interpretation of water damage and its association with AIPH was considered to have been hampered by the limited descriptive information, by the lack of standard criteria for water damage, and by the absence of a standard protocol for inspecting and recording information from home to home. Similarly, assessment of exposure to fungi or mycotoxin also was difficult to interpret because the methods did not distinguish between contamination and clinically meaningful exposure. No isolates or serologic evidence of exposure to fungi or mycotoxin were obtained in individual case-infants.

Evaluation of Analysis Methods

Three factors, considered together, contributed to the groups' conclusions that *S. chartarum* was not clearly associated with AIPH:

1. The working group found that the reported odds ratio (OR) of 9.8 for a change of 10 colony-forming units (CFU) per m^3 (*4*) was statistically unstable and potentially inflated. The estimate was very sensitive to at least three influential steps or strategies in the analysis. First, the mean airborne *S. chartarum* concentrations (CFU/m^3) for each household were calculated

incorrectly. Substituting the corrected means reduced the OR by 44% to 5.5. Second, the mean *S. chartarum* value (CFU/m^3) was imputed in one case home.† The sample was collected many months after sampling in the other case homes and, along with all other household samples collected at the same time, produced unusually heavy growth of non-*Stachybotrys* fungi, suggesting important differences in sampling technique, laboratory procedure, or environmental conditions at the time of the sampling. Exclusion of this household from the analysis§ and correcting the means reduced the OR to 1.9. Third, matching on age in a small data set created an unstable OR. Subject age would not be expected to influence concurrent measurements of airborne fungi and did not correlate with the mean *S. chartarum* CFU/m^3. Therefore, the strategy to match cases and controls based on age was unnecessary and potentially misleading. Analysis without the matching variable reduced the OR from 9.8 to 1.5.

2. Although the methods specified that sampling be done in a blinded manner (*4*), one investigator correctly inferred the identity of many case homes and wanted to be certain to identify culturable fungi in these homes if they were present. As a result, the investigator collected twice the number of air samples from case homes as were collected from control homes. In addition, investigators used aggressive, nonstandardized methods to generate artificial aerosols for sampling (e.g., vacuuming carpets and pounding on furnace ducts and furniture [*4*]), increasing the potential for differential exposure assessments of cases and controls if sampling were conducted in an unblinded manner.
3. Among homes classified as water damaged, the presence of any culturable airborne *S. chartarum* was identified in similar percentages of case and control homes (four of eight compared with three of seven) (CDC, unpublished data, February 1997). Although the numbers were small, this provided little evidence of a difference in the presence of airborne *S. chartarum* between water-damaged case and control homes. If the classifications of water damage were correct, this would suggest that water damage, or an unrecognized correlate of water damage, may be confounding any perceived association with *S. chartarum*.

Overall, the reviewers concluded that on the basis of these limitations the evidence from these studies was not of sufficient quality to support an association between *S. chartarum* and AIPH. In addition, the reviewers noted that evidence from other sources supporting a causal role of *S. chartarum* in AIPH is limited. First, AIPH is not consistent with historic accounts of animal and human illness caused by *S. chartarum* or related toxigenic fungi. Second, clusters of AIPH have not been reported in other flood-prone areas where growth of *S. chartarum* or other toxigenic fungi might be favored. Third, the mold-disease association observed in the Cleveland investigation was not observed in the investigation of a similar cluster in Chicago (*34*; CDC, unpublished data, May 1997).

Reported by: Office of the Director, CDC.

Editorial Note:

On the basis of the findings and conclusions in the reports of the CDC internal working group and the individual opinions of the external consultants, CDC advises that conclusions regarding the possible association between cases of § The working group's reported reanalysis used the value originally coded in the laboratory record (0 CFU/m^3). The result was identical to that obtained by excluding the household from the analysis. pulmonary hemorrhage/hemosiderosis in infants in Cleveland and household water

damage or exposure to *S. chartarum* are not substantiated adequately by the scientific evidence produced in the CDC investigation (*2-4*). Serious shortcomings in the collection, analysis, and reporting of data resulted in inflated measures of association and restricted interpretation of the reports. The associations should be considered not proven; the etiology of AIPH is unresolved.

As a result of the reviews, CDC will implement the following:

1. CDC will continue to investigate cases of AIPH in infants, particularly when clusters of cases can be identified.
2. CDC will continue to consider possible associations between AIPH and many possible etiologies, including household water damage or exposure to environmental hydrophilic fungi/molds such as *S. chartarum*. Standardized protocols will be recommended for data collection and environmental assessment.
3. CDC will assist in implementation of surveillance for individual cases or clusters of cases of AIPH in infants.
4. In collaboration with pediatric pulmonary specialists and with state and local health officials, a consistent standard surveillance case definition will be developed for reporting.
5. As part of future CDC investigations, CDC will enhance sampling and laboratory analytic methods to improve assessment of environmental exposures to molds/fungi.

Copies of the report of the working group and a synthesis prepared by CDC of the reports individually submitted by the external experts can be accessed at http://www.cdc.gov/od/ads , then click on "Pulmonary Hemorrhage/Hemosiderosis Among Infants."

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* The first report (*1*) described eight infants identified through November 1994. Two additional infants, identified in December 1994, were added to the original study.

† An imputed value, 4 CFU/m^3 (half the limit of detection divided by the number of plates), was used because colonies were detected on one or more of the plates, but were too few to count on the final platings and, therefore, recorded in the laboratory record as 0 CFU/m^3.

§ The working group's reported reanalysis used the value originally coded in the laboratory record (0 CFU/m^3). The result was identical to that obtained by excluding the household from the analysis.

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TOXIGENIC MOLD

A MANAGEMENT RESPONSE

Even though apartment owners/managers take necessary steps to remediate mold in their communities, residents may still find it necessary to file a mold-related claim. Understanding your insurance coverage can help you in dealing with these claims.

BY JOHN C. MANLY, ESQ.

Background

Within the last few years, claims resulting from mold and mildew have expanded exponentially nationwide. Widely publicized lawsuits, such as the Texas lawsuit filed by Melinda Ballard against Farmers Insurance Exchange, have elevated the notoriety of mold. This will likely result in even more claims. The Ballard case, which resulted in a $32 million verdict shows the possible liability that can result when one party ignores a problem of mold infestation.

Mold and mildew litigation is generally classified under the category of indoor air quality (IAQ). In general, plaintiffs allege that certain species of mold, such as Stachybotrys, Penicillium, Aspergillus, Cladosporium and other mold species, that are found in their unit have caused serious bodily injury and property damage. For the most part, this mold growth occurs as a result of water intrusion to the property.

The alleged health problems associated with mold range from allergy-type symptoms, such as wheezing and runny nose to memory loss and, in extreme situations, plaintiffs have alleged spontaneous bleeding of lungs, known as hemorrhagic lung syndrome. Mold problems do not usually arise from just the mere presence of mold, although many plaintiff attorneys would have you believe that, rather most experts agree that the mere presence of indoor mold alone is not a threat in itself. The issue is whether the mold has been "amplified" to a level where it poses a threat to human health. When that level has been reached is still up to debate within the scientific community. Although, the prudent course with any claim is to assume that there may be health concerns with any claim of mold exposure and the owner should do what is necessary within the standard of care to protect residents.

Mold requires some sort of water intrusion to grow. When the water intrusion goes unrepaired, through negligence or mere lack of knowledge it begins to feed on cellulose materials in housing units. Unfortunately, most modern buildings are filled with this type of material, ranging from drywall to ceiling tile, carpet, drapes and framing. When water and cellulose meet and the source of the moisture goes unchecked, then mold is likely to grow.

The question is, what can you as an owner or manager of an apartment community do in the face of a possible claim.

Be Proactive and Understand Your Insurance

First and foremost, understand where mold comes from. As explained, mold results from the combination of water and cellulose. You cannot prevent cellulose in your buildings, therefore you must attack the other food source: water. Typically, mold claims result when a property has a long history of water intrusion. This can be from construction defects, inadequate maintenance, such as roof or window maintenance, plumbing leaks, sewage leaks or, in some instances, resident misconduct, such as running water or poor cleaning and hygiene habits. Regardless of the cause, owners need to understand that in a modern building, water and building materials do not mix. Owners and managers would be well advised to adopt the view that water intrusion, no matter how small, should be treated with the same level of attention as imminent fire danger. This includes not only water intrusions that are visible outside the unit, but also inside the unit. As a proactive measure, it is not only advisable to inform your residents of the need to keep their units free of water and to advise the manager promptly of any leaks, but additionally to keep their units generally clean and free from conditions that promote moisture. This is often done with a well-phrased lease addendum that places a portion of the onus on the resident with regard to mold. Frequent cleaning of a unit can dramatically reduce the level of mold species, toxigenic or otherwise, located in an indoor environment.

Sometimes, no matter how carefully you plan and attempt to prevent water from intruding you will receive mold claims. Often, these mold cases arise out of typical owner/manager-resident disputes. A resident is unhappy about a rent increase, lack of customer service from a property manager or other traditional disputes. Then, a resident sees a media report on toxic mold, which, in most instances, are quite inflammatory. The resident then finds a plaintiff attorney who is familiar with indoor air quality issues. The plaintiff attorney will hire an expert to do testing, and then if the attorney feels there is sufficient evidence, will file a complaint or make a claim.

Prior to receiving this mold claim, as the owner or manager of an apartment community you should know your comprehensive general liability (CGL) policy intimately. Many owners believe that this policy will ultimately cover them for IAQ claims filed by third parties. This may or may not be the truth. As a preliminary note, defending a toxic mold claim, even a single claim, can easily run into the seven-figure range in attorney fees and expert costs alone. Moreover, the cost of remediation of hazardous mold from buildings can often exceed $10,000 per unit. Thus, as an apartment owner you must ensure that you can shift some or all of that liability to the insurance carrier.

The insurance carrier on the other hand has noted the recent climb in claims related to IAQ and has made a subtle shift to exclude coverage of mold from CGL policies. In fact, starting in 1997 the insurance industry started to include these exclusions, often without the knowledge of either the brokers or the property owners or managers, into the policies of multifamily housing professionals. Whether these claims are on the rise due to scientific advances in knowledge or several large verdicts and the public's growing consciousness is inconsequential when you discover that your policy may not cover the claim and loss.

These attempts to carve out liability for indemnification have come as a result of two definite measures by the insurance carriers. First, carriers have included a specific exclusion named the "absolute pollution exclusion." Courts have only begun to face whether or not the pollution exclusion applies to mold cases. Typically, courts have been split fairly down the middle whether all naturally and unnaturally occurring substances are included or whether only those substances, such as toxic waste and chemically engineered products, would be included in the purview of the pollution exclusion. Thus, if this provision is already written into your CGL you may want to have an attorney determine if you are in a jurisdiction that may include mold under the pollution exclusion and therefore deny your claim.

Secondly, there has been a rise of carriers who have written a specific mold exclusion into many policies. Although, courts have apparently not yet examined this issue, it is likely that they would deny the claim, solely on the plain language of the policy. Thus, you must know your policy intimately. If you don't have it, request it from your broker. Examine it thoroughly, and determine if any specific exclusions are applied. Even if you don't see any specific exclusions, ask your broker

whether or not there is any language present in the policy that might be construed to deny coverage of mold. In some instances one should notify their broker in writing that they want mold coverage. Where enforceable mold policies exist, environmental policies may be available. Although somewhat expensive, these policies may be worth the price given the huge downside to litigating these claims with one's own resources.

In addition to your own CGL policy that covers the property, hopefully without applicable exclusions, owners can further protect themselves during the construction, repair, or maintenance of a property. A practical step to take is to be certain that every vendor and/or contractor who touches their building sign enforceable indemnity agreements and agree to provide a CGL insurance policy where the owner or manager is listed as an additional insured under the policy. In your contract with these various entities, it should be required that their policy contain no mold exclusions or other indoor air quality exclusions. Depending on your jurisdiction, these contractual provisions must be carefully drafted to comply with various laws. As a practical point, if these contractors fail to comply with the provisions of the contract, you may have a breach of contract action against them, where they may be obligated to indemnify you for mold claims.

When in the process of remediating and interpreting mold health risks there are excellent resources available from highly reputable sources to help you. A mold claim that has been dealt with and properly remediated can often insulate you from further liability and litigation down the road. The Environmental Protection Agency (www.epa.gov/ iaq) has enormous resources devoted to indoor air quality. One authoritative guide they have developed, *Mold Remediation in Schools and Commercial Buildings*, addresses how to investigate, evaluate and remediate mold problems. Though this guide is labeled for commercial buildings, its principles can equally be attributed to residential properties. The New York Department of Health (www.ci.nyc.ny.us/html/doh/home.html) has been on the forefront in terms of cities recognizing that a mold problem may exist. It published a guide called, Guidelines on Assessment and Remediation of Fungi in Indoor Environments. The guide is a compilation of the health problems that may arise from mold and how to assess if it exists. Many states are beginning to enact ordinances and statutes that recognize and deal with the existence of mold in indoor environments. As a property owner/manager, it is wise to inform yourself of the bills that are winding their way through various state legislatures, not only in your jurisdiction, but in other jurisdictions as well. NAA's State and Local Policy Department is a great resource and provides regular updates on state legislation to members.This issue is only on the rise and therefore it is best to inform yourself and your staff on how to deal with the issue prior to it truly becoming full-blown litigation.

By adopting some of these suggestions and being proactive and moreover knowing their properties, owners and managers will save themselves time and money, and potentially prevent any harm to their resident's health or property.

I Receive A Claim, What Should I Do?

As a result of your foresight, you should have a valid policy in place, and therefore you should immediately contact your attorney and have them "tender" your claim to your general liability carrier. This starts the clock, essentially placing them on notice of your claim. Your attorney may also wish to consider tendering the claim to the general liability carriers who covered the building or project in question in the years prior to receiving the claim. The reason for this is simple. In the 1998 California Supreme Court case of, *Montrose Chemical Company v. Superior Court*, the Court held that a CGL policy written as an "occurrence policy," a "potential for coverage" exists in environmental or construction defect claims from the date the loss could have occurred. This could mean that the case could cover prior years from the date the mold first began to grow. Once this potential for coverage exists under *Montrose* the carrier's duty is triggered and they must pay for defense of the claim. The carrier, as your representative, will usually either settle the claim or try the case and pay any judgement that results. Because mold can grow unknown for years within the walls of a residential property several general liability policies may be implicated in addition to the one currently in effect. Thus, the prudent course is to assert your right to coverage anytime where there may be a "potential for coverage." A court may conceivably determine that the mold that is at issue in a case may have existed for five, 10 or any number of years, and also determine that the policies in effect during those years should cover the defense. Policies from years prior to 1998, for the most part, do not have the mold exclusions delineated above and therefore an insurance carrier would be obligated to cover the claim. Therefore, it is important to tender claims for policies as far back as the resident may have lived in the unit, in the case of health complaints, or as long as you owned the property, for property claims.

Where a definite mold exclusion exists in your policy, you will want to tender other policies that may be in effect as well, without that exclusion. Due to the unsettled law with respect to the "absolute pollution exclusion," you should tender your claim to carriers with this exclusion in their policy and demand coverage. This is especially important in jurisdictions, such as California, where the insurer owes their insured a "duty of good faith." If the policy on its face is unclear whether or not mold is excluded, then the "potential for coverage" ultimately demands that the carrier cover the claim. The "duty of good faith" is a powerful tool in the hands of insureds. The *Ballard* suit that resulted in a $32 million verdict was the result of allegations that Farmers had failed to handle her claim properly. Essentially a failure to act in good faith claim. Thus, carriers have become wary of mishandling claims or denying coverage outright.

After you tender the claim, your insurance carrier may attempt to contact you to take an oral statement. You are obligated to cooperate with the insurer, however you also have a right, and are advised, to seek the advice of your counsel and have him present during any interview.

If your insurance carrier wrongfully denies your claim, you may have a bad faith/breach of contract claim against your insurer. Moreover, where carriers "reserve their rights," insureds may have the right to their own attorney at the insurance company's expense. We strongly recommend that whenever these claims arise that insureds contact counsel familiar with IAQ issues and assist them in attempting to obtain insurance coverage.

Whether or not your insurance carrier ultimately picks up your claim, you must still address the problem. Thus, in addition to tendering your

claim, you should also hire an industrial hygienist or other air quality professional to evaluate the resident's claims. Owners should strictly follow the advice of their indoor air quality professional in addressing any health concerns and any remediation that is necessary. The ultimate goal is to be focused on truly addressing any health issues that may arise as from your management of a building and resolving those issues in a cost efficient and thorough manner. In this spirit, you will want to deal directly with the resident, advise them that a problem may exist and how the property owner and management are dealing with it. Until the science is more clear, we recommend that owners err on the side of caution and deal with the problem openly and honestly. Moreover, you should document everything showing that you hired professionals and dealt with the problem rather than ignored it. The testimony of an expert stating that you did everything you were supposed to do usually carries a lot of weight with a jury when it comes to handing down a verdict.

Residents who complain about mold may not only do so in a lawsuit. They may complain to the city or the health department. Public entities have thus begun to recognize the rise of mold in the public consciousness. For instance, San Francisco, among the first to do so, has declared mold a nuisance under the health code, in an ordinance enacted just in June. Where a property has any "visible or demonstrable growth of mold or mildew in the interiors of any buildings," the director of public health may demand that that property be remediated within a set amount of time. If that order is not complied with, then the health agency may remediate the property and bill the owner or manager for the service. The city or the department of health may, unlike a lawsuit, demand immediate compliance with mold clean up. Furthermore, this ordinance may provide the basis for liability under negligence per se cause of action. This would in effect remove liability defenses and leave the property owner open to lawsuits. Thus, you should be aware that your city or jurisdiction may likewise begin to enact similar legislation that you will be required to know and comply with.

When a claim of mold arises, as a property owner/manager, you should already have a plan to place in motion, wherein you evaluate the problem, and if a problem exists you thoroughly remediate it promptly. Many owners are using the New York City guidelines and EPA's school guidelines as a baseline for their operation and maintenance plans. Minor infestations that are visible to the eye may ultimately be handled by onsite maintenance, however when levels increase a certified professional, remediation professional and an industrial hygienist will likely become necessary. Mold may become airborne and invisible and thus it is always prudent to seek professional advice where an allegation of mold arises.

Owners and managers cannot ultimately prevent claims arising of mold, they can only attempt to insulate themselves from liability with numerous protective measures, both prior to the suit arising and after it comes to fruition. It is always advisable to seek out professional advice with all facets of your business, from seeking insurance coverage to contractual relationships with your residents, vendors and construction company—especially so in this new frontier of mold claims.

Conclusion

As multifamily professionals it is always wise to inform yourself of all potential liabilities on your properties. A wise owner is proactive and deals with the problem prior to it ever arising, if it does at all, with detailed guidelines and resident information and a valid insurance policy(s). This article is a basic overview of some of the legal issues presented in mold claims. It is only a brief overview and is by no means intended to be a comprehensive review of the area. ■

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New York City Department of Health
Bureau of Environmental & Occupational Disease Epidemiology

Guidelines on Assessment and Remediation of Fungi in Indoor Environments

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Executive Summary

On May 7, 1993, the New York City Department of Health (DOH), the New York City Human Resources Administration (HRA), and the Mt. Sinai Occupational Health Clinic convened an expert panel on *Stachybotrys atra* in Indoor Environments. The purpose of the panel was to develop policies for medical and environmental evaluation and intervention to address *Stachybotrys atra* (now known as *Stachybotrys chartarum* (SC)) contamination. The original guidelines were developed because of mold growth problems in several New York City buildings in the early 1990's. This document revises and expands the original guidelines to include all fungi (mold). It is based both on a review of the literature regarding fungi and on comments obtained by a review panel consisting of experts in the fields of microbiology and health sciences. It is intended for use by building engineers and management, but is available for general distribution to anyone concerned about fungal contamination, such as environmental consultants, health professionals, or the general public.

We are expanding the guidelines to be inclusive of all fungi for several reasons:

- Many fungi (e.g., species of *Aspergillus, Penicillium, Fusarium, Trichoderma,* and *Memnoniella*)

in addition to SC can produce potent mycotoxins, some of which are identical to compounds produced by SC. Mycotoxins are fungal metabolites that have been identified as toxic agents. For this reason, SC cannot be treated as uniquely toxic in indoor environments.

- People performing renovations/cleaning of widespread fungal contamination may be at risk for developing Organic Dust Toxic Syndrome (ODTS) or Hypersensitivity Pneumonitis (HP). ODTS may occur after a *single heavy* exposure to dust contaminated with fungi and produces flu-like symptoms. It differs from HP in that it is not an immune-mediated disease and does not require repeated exposures to the same causative agent. A variety of biological agents may cause ODTS including common species of fungi. HP may occur after repeated exposures to an allergen and can result in permanent lung damage.

- Fungi can cause allergic reactions. The most common symptoms are runny nose, eye irritation, cough, congestion, and aggravation of asthma.

Fungi are present almost everywhere in indoor and outdoor environments. The most common symptoms of fungal exposure are runny nose, eye irritation, cough, congestion, and aggravation of asthma. Although there is evidence documenting severe health effects of fungi in humans, most of this evidence is derived from ingestion of contaminated foods (i.e., grain and peanut products) or occupational exposures in agricultural settings where inhalation exposures were very high. With the possible exception of remediation to very heavily contaminated indoor environments, such high-level exposures are not expected to occur while performing remedial work.

There have been reports linking health effects in office workers to offices contaminated with moldy surfaces and in residents of homes contaminated with fungal growth. Symptoms, such as fatigue, respiratory ailments, and eye irritation were typically observed in these cases. Some studies have suggested an association between SC and pulmonary hemorrhage/hemosiderosis in infants, generally those less than six months old. Pulmonary hemosiderosis is an uncommon condition that results from bleeding in the lungs. The cause of this condition is unknown, but may result from a combination of environmental contaminants and conditions (e.g., smoking, fungal contaminants and other bioaerosols, and water-damaged homes), and currently its association with SC is unproven.

The focus of this guidance document addresses mold contamination of building components (walls, ventilation systems, support beams, etc.) that are chronically moist or water damaged. Occupants should address common household sources of mold, such as mold found in bathroom tubs or between tiles with household cleaners. Moldy food (e.g., breads, fruits, etc.) should be discarded.

Building materials supporting fungal growth must be remediated *as rapidly as possible* in order to ensure a healthy environment. Repair of the defects that led to water accumulation (or elevated humidity) should be conducted in conjunction with or prior to fungal remediation. Specific methods of assessing and remediating fungal contamination should be based on the extent of visible contamination and underlying damage. The simplest and most expedient remediation that is reasonable, and properly and safely removes fungal contamination, should be used. Remediation and assessment methods are described in this document.

The use of respiratory protection, gloves, and eye protection is recommended. Extensive contamination, particularly if heating, ventilating, air conditioning (HVAC) systems or large occupied spaces are

involved, should be assessed by an experienced health and safety professional and remediated by personnel with training and experience handling environmentally contaminated materials. Lesser areas of contamination can usually be assessed and remediated by building maintenance personnel. In order to prevent contamination from recurring, underlying defects causing moisture buildup and water damage must be addressed. Effective communication with building occupants is an essential component of all remedial efforts.

Fungi in buildings may cause or exacerbate symptoms of allergies (such as wheezing, chest tightness, shortness of breath, nasal congestion, and eye irritation), especially in persons who have a history of allergic diseases (such as asthma and rhinitis). Individuals with persistent health problems that appear to be related to fungi or other bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Decisions about removing individuals from an affected area must be based on the results of such medical evaluation, and be made on a case-by-case basis. Except in cases of widespread fungal contamination that are linked to illnesses throughout a building, building-wide evacuation is not indicated.

In summary, prompt remediation of contaminated material and infrastructure repair is the primary response to fungal contamination in buildings. Emphasis should be placed on preventing contamination through proper building and HVAC system maintenance and prompt repair of water damage.

This document is not a legal mandate and should be used as a guideline. Currently there are no United States Federal, New York State, or New York City regulations for evaluating potential health effects of fungal contamination and remediation. These guidelines are subject to change as more information regarding fungal contaminants becomes available.

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Introduction

On May 7, 1993, the New York City Department of Health (DOH), the New York City Human Resources Administration (HRA), and the Mt. Sinai Occupational Health Clinic convened an expert panel on *Stachybotrys atra* in Indoor Environments. The purpose of the panel was to develop policies for medical and environmental evaluation and intervention to address *Stachybotrys atra* (now known as *Stachybotrys chartarum* (SC)) contamination. The original guidelines were developed because of mold growth problems in several New York City buildings in the early 1990's. This document revises and expands the original guidelines to include all fungi (mold). It is based both on a review of the literature regarding fungi and on comments obtained by a review panel consisting of experts in the fields of microbiology and health sciences. It is intended for use by building engineers and management, but is available for general distribution to anyone concerned about fungal contamination, such as environmental consultants, health professionals, or the general public.

This document contains a discussion of potential health effects; medical evaluations; environmental assessments; protocols for remediation; and a discussion of risk communication strategy. The guidelines are divided into four sections:

1. Health Issues; 2. Environmental Assessment; 3. Remediation; and 4. Hazard Communication.

We are expanding the guidelines to be inclusive of all fungi for several reasons:

- Many fungi (e.g., species of *Aspergillus, Penicillium, Fusarium, Trichoderma,* and *Memnoniella*) in addition to SC can produce potent mycotoxins, some of which are identical to compounds produced by SC.[1, 2, 3, 4] Mycotoxins are fungal metabolites that have been identified as toxic agents. For this reason, SC cannot be treated as uniquely toxic in indoor environments.

- People performing renovations/cleaning of widespread fungal contamination may be at risk for developing Organic Dust Toxic Syndrome (ODTS) or Hypersensitivity Pneumonitis (HP). ODTS may occur after a *single heavy* exposure to dust contaminated with fungi and produces flu-like symptoms. It differs from HP in that it is not an immune-mediated disease and does not require repeated exposures to the same causative agent. A variety of biological agents may cause ODTS including common species of fungi. HP may occur after repeated exposures to an allergen and can result in permanent lung damage.[5, 6, 7, 8, 9, 10]

- Fungi can cause allergic reactions. The most common symptoms are runny nose, eye irritation, cough, congestion, and aggravation of asthma.[11, 12]

Fungi are present almost everywhere in indoor and outdoor environments. The most common symptoms of fungal exposure are runny nose, eye irritation, cough, congestion, and aggravation of asthma. Although there is evidence documenting severe health effects of fungi in humans, most of this evidence is derived from ingestion of contaminated foods (i.e., grain and peanut products) or occupational exposures in agricultural settings where inhalation exposures were very high.[13, 14] With the possible exception of remediation to very heavily contaminated indoor environments, such high level exposures are not expected to occur while performing remedial work.[15]

There have been reports linking health effects in office workers to offices contaminated with moldy surfaces and in residents of homes contaminated with fungal growth.[12, 16, 17, 18, 19, 20] Symptoms, such as fatigue, respiratory ailments, and eye irritation were typically observed in these cases.

Some studies have suggested an association between SC and pulmonary hemorrhage/hemosiderosis in infants, generally those less than six months old. Pulmonary hemosiderosis is an uncommon condition that results from bleeding in the lungs. The cause of this condition is unknown, but may result from a combination of environmental contaminants and conditions (e.g., smoking, other microbial contaminants, and water-damaged homes), and currently its association with SC is unproven.[21, 22, 23]

The focus of this guidance document addresses mold contamination of building components (walls, ventilation systems, support beams, etc.) that are chronically moist or water damaged. Occupants should address common household sources of mold, such as mold found in bathroom tubs or between tiles with household cleaners. Moldy food (e.g., breads, fruits, etc.) should be discarded.

This document is not a legal mandate and should be used as a guideline. Currently there are no United States Federal, New York State, or New York City regulations for evaluating potential health effects of fungal contamination and remediation. These guidelines are subject to change as more information regarding fungal contaminants becomes available.

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1. Health Issues

1.1 Health Effects

Inhalation of fungal spores, fragments (parts), or metabolites (e.g., mycotoxins and volatile organic compounds) from a wide variety of fungi may lead to or exacerbate immunologic (allergic) reactions, cause toxic effects, or cause infections.[11, 12, 24]

There are only a limited number of documented cases of health problems from indoor exposure to fungi. The intensity of exposure and health effects seen in studies of fungal exposure in the indoor environment was typically much less severe than those that were experienced by agricultural workers but were of a long-term duration.[5-10, 12, 14, 16-20, 25-27] Illnesses can result from both high level, short-term exposures and lower level, long-term exposures. The most common symptoms reported from exposures in indoor environments are runny nose, eye irritation, cough, congestion, aggravation of asthma, headache, and fatigue.[11, 12, 16-20]

The presence of fungi on building materials as identified by a visual assessment or by bulk/surface sampling results does not necessitate that people will be exposed or exhibit health effects. In order for humans to be exposed indoors, fungal spores, fragments, or metabolites must be released into the air and inhaled, physically contacted (dermal exposure), or ingested. Whether or not symptoms develop in people exposed to fungi depends on the nature of the fungal material (e.g., allergenic, toxic, or infectious), the amount of exposure, and the susceptibility of exposed persons. Susceptibility varies with the genetic predisposition (e.g., allergic reactions do not always occur in all individuals), age, state of health, and concurrent exposures. For these reasons, and because measurements of exposure are not standardized and biological markers of exposure to fungi are largely unknown, it is not possible to determine "safe" or "unsafe" levels of exposure for people in general.

1.1.1 Immunological Effects

Immunological reactions include asthma, HP, and allergic rhinitis. Contact with fungi may also lead to dermatitis. It is thought that these conditions are caused by an immune response to fungal agents. The most common symptoms associated with allergic reactions are runny nose, eye irritation, cough, congestion, and aggravation of asthma.[11, 12] HP may occur after repeated exposures to an allergen and can result in permanent lung damage. HP has typically been associated with repeated heavy exposures in agricultural settings but has also been reported in office settings.[25, 26, 27] Exposure to fungi through renovation work may also lead to initiation or exacerbation of allergic or respiratory symptoms.

1.1.2 Toxic Effects

A wide variety of symptoms have been attributed to the toxic effects of fungi. Symptoms, such as fatigue, nausea, and headaches, and respiratory and eye irritation have been reported. Some of the symptoms related to fungal exposure are non-specific, such as discomfort, inability to concentrate, and fatigue.[11, 12, 16-20] Severe illnesses such as ODTS and pulmonary hemosiderosis have also been

attributed to fungal exposures.[5-10, 21, 22]

ODTS describes the abrupt onset of fever, flu-like symptoms, and respiratory symptoms in the hours following a *single, heavy* exposure to dust containing organic material including fungi. It differs from HP in that it is not an immune-mediated disease and does not require repeated exposures to the same causative agent. ODTS may be caused by a variety of biological agents including common species of fungi (e.g., species of *Aspergillus* and *Penicillium*). ODTS has been documented in farm workers handling contaminated material but is also of concern to workers performing renovation work on building materials contaminated with fungi.[5-10]

Some studies have suggested an association between SC and pulmonary hemorrhage/hemosiderosis in infants, generally those less than six months old. Pulmonary hemosiderosis is an uncommon condition that results from bleeding in the lungs. The cause of this condition is unknown, but may result from a combination of environmental contaminants and conditions (e.g., smoking, fungal contaminants and other bioaerosols, and water-damaged homes), and currently its association with SC is unproven.[21, 22, 23]

1.1.3 Infectious Disease

Only a small group of fungi have been associated with infectious disease. Aspergillosis is an infectious disease that can occur in immunosuppressed persons. Health effects in this population can be severe. Several species of *Aspergillus* are known to cause aspergillosis. The most common is *Aspergillus fumigatus*. Exposure to this common mold, even to high concentrations, is unlikely to cause infection in a healthy person.[11, 24]

Exposure to fungi associated with bird and bat droppings (e.g., *Histoplasma capsulatum* and *Cryptococcus neoformans*) can lead to health effects, usually transient flu-like illnesses, in healthy individuals. Severe health effects are primarily encountered in immunocompromised persons.[24, 28, 29]

1.2 Medical Evaluation

Individuals with persistent health problems that appear to be related to fungi or other bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Infants (less than 12 months old) who are experiencing non-traumatic nosebleeds or are residing in dwellings with damp or moldy conditions and are experiencing breathing difficulties should receive a medical evaluation to screen for alveolar hemorrhage. Following this evaluation, infants who are suspected of having alveolar hemorrhaging should be referred to a pediatric pulmonologist. Infants diagnosed with pulmonary hemosiderosis and/or pulmonary hemorrhaging should not be returned to dwellings until remediation and air testing are completed.

Clinical tests that can determine the source, place, or time of exposure to fungi or their products are not currently available. Antibodies developed by exposed persons to fungal agents can only document that exposure has occurred. Since exposure to fungi routinely occurs in both outdoor and indoor environments this information is of limited value.

1.3 Medical Relocation

Infants (less than 12 months old), persons recovering from recent surgery, or people with immune suppression, asthma, hypersensitivity pneumonitis, severe allergies, sinusitis, or other chronic inflammatory lung diseases may be at greater risk for developing health problems associated with certain fungi. Such persons should be removed from the affected area during remediation (see Section 3, Remediation). Persons diagnosed with fungal related diseases should not be returned to the affected areas until remediation and air testing are completed.

Except in cases of widespread fungal contamination that are linked to illnesses throughout a building, a building-wide evacuation is not indicated. A trained occupational/environmental health practitioner should base decisions about medical removals in the occupational setting on the results of a clinical assessment.

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2. Environmental Assessment

The presence of mold, water damage, or musty odors should be addressed immediately. In all instances, any source(s) of water must be stopped and the extent of water damaged determined. Water damaged materials should be dried and repaired. Mold damaged materials should be remediated in accordance with this document (see Section 3, Remediation).

2.1 Visual Inspection

A visual inspection is the most important initial step in identifying a possible contamination problem. The extent of any water damage and mold growth should be visually assessed. This assessment is important in determining remedial strategies. Ventilation systems should also be visually checked, particularly for damp filters but also for damp conditions elsewhere in the system and overall cleanliness. Ceiling tiles, gypsum wallboard (sheetrock), cardboard, paper, and other cellulosic surfaces should be given careful attention during a visual inspection. The use of equipment such as a boroscope, to view spaces in ductwork or behind walls, or a moisture meter, to detect moisture in building materials, may be helpful in identifying hidden sources of fungal growth and the extent of water damage.

2.2 Bulk/Surface Sampling

a. Bulk or surface sampling is not required to undertake a remediation. Remediation (as described in Section 3, Remediation) of visually identified fungal contamination should proceed without further evaluation.

b. Bulk or surface samples may need to be collected to identify specific fungal contaminants as part of a medical evaluation if occupants are experiencing symptoms which may be related to fungal exposure or to identify the presence or absence of mold if a visual inspection is equivocal (e.g., discoloration, and staining).

c. An individual trained in appropriate sampling methodology should perform bulk or surface

sampling. Bulk samples are usually collected from visibly moldy surfaces by scraping or cutting materials with a clean tool into a clean plastic bag. Surface samples are usually collected by wiping a measured area with a sterile swab or by stripping the suspect surface with clear tape. Surface sampling is less destructive than bulk sampling. Other sampling methods may also be available. A laboratory specializing in mycology should be consulted for specific sampling and delivery instructions.

2.3 Air Monitoring

a. Air sampling for fungi should not be part of a routine assessment. This is because decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some fungi are prone to false negative results and therefore cannot be used to definitively rule out contamination.

b. Air monitoring may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with a fungal exposure (e.g., pulmonary hemorrhage/hemosiderosis, and aspergillosis).

c. Air monitoring may be necessary if there is evidence from a visual inspection or bulk sampling that ventilation systems may be contaminated. The purpose of such air monitoring is to assess the extent of contamination throughout a building. It is preferable to conduct sampling while ventilation systems are operating.

d. Air monitoring may be necessary if the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling (e.g., mold growth behind walls). The purpose of such air monitoring is to determine the location and/or extent of contamination.

e. If air monitoring is performed, for comparative purposes, outdoor air samples should be collected concurrently at an air intake, if possible, and at a location representative of outdoor air. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."

f. Personnel conducting the sampling must be trained in proper air sampling methods for microbial contaminants. A laboratory specializing in mycology should be consulted for specific sampling and shipping instructions.

2.4 Analysis of Environmental Samples

Microscopic identification of the spores/colonies requires considerable expertise. These services are not routinely available from commercial laboratories. Documented quality control in the laboratories used for analysis of the bulk/surface and air samples is necessary. The American Industrial Hygiene Association (AIHA) offers accreditation to microbial laboratories (Environmental Microbiology Laboratory Accreditation Program (EMLAP)). Accredited laboratories must participate in quarterly proficiency testing (Environmental Microbiology

Proficiency Analytical Testing Program (EMPAT)).

Evaluation of bulk/surface and air sampling data should be performed by an experienced health professional. The presence of few or trace amounts of fungal spores in bulk/surface sampling should be considered background. Amounts greater than this or the presence of fungal fragments (e.g., hyphae, and conidiophores) may suggest fungal colonization, growth, and/or accumulation at or near the sampled location.[30] Air samples should be evaluated by means of comparison (i.e., indoors to outdoors) and by fungal type (e.g., genera, and species). In general, the levels and types of fungi found should be similar indoors (in non-problem buildings) as compared to the outdoor air. Differences in the levels or types of fungi found in air samples may indicate that moisture sources and resultant fungal growth may be problematic.

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3. Remediation

In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur. Any initial water infiltration should be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity should be maintained at levels below 60% to inhibit mold growth.[31] Emphasis should be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.

Five different levels of abatement are described below. The size of the area impacted by fungal contamination primarily determines the type of remediation. The sizing levels below are based on professional judgement and practicality; currently there is not adequate data to relate the extent of contamination to frequency or severity of health effects. **The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.** The listed remediation methods were designed to achieve this goal, however, due to the general nature of these methods it is the responsibility of the people conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, should be carefully considered prior to implementation.

Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are structurally sound and are visibly moldy can be cleaned and reused. Cleaning should be done using a detergent solution. Porous materials such as ceiling tiles and insulation, and wallboards with more than a small area of contamination should be removed and discarded. Porous materials (e.g., wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded if possible. A professional restoration consultant should be contacted when restoring porous materials with more than a small area of fungal contamination. All materials to be reused should be dry and visibly free from mold. Routine inspections should be conducted to confirm the effectiveness of remediation work.

The use of gaseous ozone or chlorine dioxide for remedial purposes is **not** recommended. Both compounds are highly toxic and contamination of occupied space may pose a health threat. Furthermore, the effectiveness of these treatments is unproven. For additional information on the use of biocides for

remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."

3.1 *Level I*: Small Isolated Areas (10 sq. ft or less) - e.g., ceiling tiles, small areas on walls

a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

c. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

e. Contaminated materials that cannot be cleaned should be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.

f. The work area and areas used by remedial workers for egress should be cleaned with a damp cloth and/or mop and a detergent solution.

g. All areas should be left dry and visibly free from contamination and debris.

3.2 *Level II*: Mid-Sized Isolated Areas (10 - 30 sq. ft.) - e.g., individual wallboard panels.

a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

c. The work area should be unoccupied. Vacating people from spaces adjacent to the work area

is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

d. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.

e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

f. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

g. The work area and areas used by remedial workers for egress should be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.

h. All areas should be left dry and visibly free from contamination and debris.

3.3 *Level III*: Large Isolated Areas (30 - 100 square feet) - e.g., several wallboard panels.

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project.

The following procedures *at a minimum* are recommended:

a. Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

b. The work area and areas directly adjacent should be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.

c. Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.

d. The work area and areas directly adjacent should be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

f. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

g. The work area and surrounding areas should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.

h. All areas should be left dry and visibly free from contamination and debris.

If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.

3.4 *Level IV*: Extensive Contamination (greater than 100 contiguous square feet in an area)

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project. The following procedures are recommended:

a. Personnel trained in the handling of hazardous materials equipped with:

   i. Full-face respirators with high efficiency particulate air (HEPA) cartridges
   ii. Disposable protective clothing covering both head and shoes
   iii. Gloves

b. Containment of the affected area:

   i. Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
   ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization
   iii. Airlocks and decontamination room

c. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

d. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their

transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.

e. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.

f. Air monitoring should be conducted prior to occupancy to determine if the area is fit to reoccupy.

3.5 *Level V*: Remediation of HVAC Systems

3.5.1 A Small Isolated Area of Contamination (<10 square feet) in the HVAC System

a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

c. The HVAC system should be shut down prior to any remedial activities.

d. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.

e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

f. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

g. The work area and areas immediately surrounding the work area should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.

h. All areas should be left dry and visibly free from contamination and debris.

i. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

3.5.2 Areas of Contamination (>10 square feet) in the HVAC System

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. The following procedures are recommended:

a. Personnel trained in the handling of hazardous materials equipped with:

   i. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
   ii. Gloves and eye protection
   iii. Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes should be worn if contamination is greater than 30 square feet.

b. The HVAC system should be shut down prior to any remedial activities.

c. Containment of the affected area:

   i. Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
   ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization.
   iii. Airlocks and decontamination room if contamination is greater than 30 square feet.

d. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.

e. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.

f. All areas should be left dry and visibly free from contamination and debris.

g. Air monitoring should be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.

h. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

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4. Hazard Communication

When fungal growth requiring large-scale remediation is found, the building owner, management, and/or employer should notify occupants in the affected area(s) of its presence. Notification should include a description of the remedial measures to be taken and a timetable for completion. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals with persistent health problems that appear to be related to bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Individuals seeking medical attention should be provided with a copy of all inspection results and interpretation to give to their medical practitioners.

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Conclusion

In summary, the prompt remediation of contaminated material and infrastructure repair must be the primary response to fungal contamination in buildings. The simplest and most expedient remediation that properly and safely removes fungal growth from buildings should be used. In all situations, the underlying cause of water accumulation must be rectified or the fungal growth will recur. Emphasis should be placed on preventing contamination through proper building maintenance and prompt repair of water damaged areas.

Widespread contamination poses much larger problems that must be addressed on a case-by-case basis in consultation with a health and safety specialist. Effective communication with building occupants is an essential component of all remedial efforts. Individuals with persistent health problems should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures.

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For further information regarding this document please contact the New York City Department of Health at (212) 788-4290.

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California Department of Health Services

Indoor Air Quality *Info Sheet*

Mold in My Home: What Do I Do?

March 1998

This fact sheet provides information to people who have experienced water damage to their home and presents the health concerns related to mold exposure. It also provides general guidelines on mold detection, cleanup & removal of mold contaminated materials.

ABOUT MOLD

What is it? Molds are simple, microscopic organisms, found virtually everywhere, indoors and outdoors. Molds can be found on plants, foods, dry leaves, and other organic material. Molds are needed for breaking down dead material. Mold spores are very tiny and lightweight, and this allows them to travel through the air. Mold growths can often be seen in the form of discoloration, ranging from white to orange and from green to brown and black. When molds are present in large quantities, they can cause allergic symptoms similar to those caused by plant pollen.

Should I be concerned about mold in my home? Yes, if the contamination is extensive. When airborne mold spores are present in large numbers, they can cause allergic reactions, asthma episodes, infections, and other respiratory problems for people. Exposure to high spore levels can cause the development of an allergy to the mold. Mold can also cause structural damage to your home. Similarly, when wood goes through a period of wetting, then drying, it can eventually warp and cause walls to crack or become structurally weak.

What does mold need to grow? For mold to grow, it needs:

- food sources - such as leaves, wood, paper, or dirt
- a source of moisture
- a place to grow

Can mold become a problem in my home? Yes, if there is moisture available to allow mold to thrive and multiply. The following are sources of indoor moisture that may cause problems:

- flooding
- backed-up sewers
- leaky roofs
- humidifiers
- mud or ice dams
- damp basement or crawl spaces
- constant plumbing leaks
- house plants -- watering can generate large amounts of moisture
- steam from cooking

- shower/bath steam and leaks
- wet clothes on indoor drying lines
- clothes dryers vented indoors
- combustion appliances (e.g. stoves) not exhausted to the outdoors

CAUTION: If you see moisture condensation on the windows or walls, it is also possible that you have a combustion problem in your home. It is important to have sufficient fresh air available for fuel burning appliances, such as the furnace, water heater, stove/range, clothes dryer, as well as a fireplace. A shortage of air for these appliances can result in *back drafting* of dangerous gases such as **carbon monoxide** into the home. To prevent back drafting of air, you need either open vents or a ventilation system that brings fresh air into the home to replace air that is exhausted out. *Have your local utility company or a professional heating contractor inspect your fuel-burning appliances annually*.

HEALTH EFFECTS

How am I exposed to indoor molds? Mold is found everywhere, indoors and outdoors. It is common to find mold spores in the air of homes and growing on damp surfaces. Much of the mold found indoors comes from outdoor sources. Therefore, everyone is exposed to some mold on a daily basis without evident harm. Mold spores primarily cause health problems when they enter the air and are inhaled in large number. People can also be exposed to mold through skin contact and eating.

How much mold can make me sick? It depends. For some people, a relatively small number of mold spores can cause health problems. For other people, it may take many more. The basic rule is, if you can see or smell it, take steps to eliminate the excess moisture, and to cleanup and remove the mold.

Who is at greater risk when exposed to mold? Exposure to mold is not healthy for anyone inside buildings. It is important to quickly identify and correct any moisture sources before health problems develop. The following individuals appear to be at higher risk for adverse health effects of molds:

- Infants and children
- elderly
- immune compromised patients (people with HIV infection, cancer chemotherapy, liver disease, etc.)
- pregnant women
- individuals with existing respiratory conditions, such as allergies, multiple chemical sensitivity, and asthma.

People with these special concerns should consult a physician if they are having health problems.

What symptoms are common? Allergic reactions may be the most common health problem of mold exposure. Typical symptoms reported (alone or in combination) include:

- respiratory problems, such as wheezing, and difficulty in breathing
- nasal and sinus congestion
- eyes-burning, watery, reddened, blurry vision, light sensitivity
- dry, hacking cough
- sore throat

- nose and throat irritation
- shortness of breath
- skin irritation
- central nervous system problems (constant headaches, memory problems, and mood changes)
- aches and pains
- possible fever

Are some molds more hazardous than others? Allergic persons vary in their sensitivities to mold, both as to amount and type needed to cause reactions. In addition, certain types of molds can produce toxins, called *mycotoxins*, that the mold uses to inhibit or prevent the growth of other organisms. Mycotoxins are found in both living and dead mold spores. **Materials permeated with mold need to be removed, even after they are disinfected with cleaning solutions.** Allergic and toxic effects can remain in dead spores. Exposure to mycotoxins may present a greater hazard than that of allergenic or irritative molds. Mycotoxins have been found in homes, agricultural settings, food, and office buildings.

DETECTION OF MOLD

How can I tell if I have mold in my house? If you can see mold, or if there is an earthy or musty odor, you can assume you have a mold problem. Allergic individuals may experience the symptoms listed above. Look for previous water damage. Visible mold growth is found underneath materials where water has damaged surfaces, or behind walls. Look for discoloration and leaching from plaster.

Should I test my home for mold? The California Department of Health Services does not recommend testing as the first step to determine if you have a mold problem. Reliable sampling for mold can be expensive, and requires equipment not available to the general public. Residents of individual private homes must pay a contractor to carry out such sampling, as it is not usually done by public health agencies. Mold cleanup is usually considered one of the housekeeping tasks of the private citizen, along with roof and plumbing repairs, sweeping and house cleaning.

Another problem is that there are few available standards for judging what **is** an acceptable quantity of mold. In all locations, there is some outdoor levels of molds. If sampling is carried out, an outdoor air sample needs to be taken at the same time as the sample indoors, to provide a baseline measurement. Since the susceptibility of individuals varies so greatly, sampling is at best a general guide.

The simplest approach is: if you can see or smell mold, you have a problem. Once you know the problem exists, follow the procedure given next.

Unless the source of moisture is removed and the contaminated area is cleaned and disinfected, mold growth is likely to reoccur.

GENERAL CLEAN-UP PROCEDURES

- Identify and correct the moisture source
- Clean, disinfect, and dry the moldy area
- Bag and dispose any material that has moldy residues, such as rags, paper, leaves, or debris.

What can I save? What should I toss? Substances that are porous and can trap molds, such as paper, rags, wallboard, and rotten wood should be decontaminated and thrown out. Harder materials such as glass, plastic, or metal can be kept after they are cleaned and disinfected.

Ultimately, it is critical to remove the source of moisture first, before beginning remedial action, since mold growth will return shortly if an effected area becomes re-wetted.

Removal of Moldy Materials After fixing the moisture source and removing excess moisture, the cleanup can begin:

- Wear gloves when handling moldy materials
- Remove porous materials (examples: ceiling tiles, sheetrock, carpeting, wood products)
- Carpeting can be a difficult problem -- drying does not remove the dead spores. If there is heavy mold, disposal of the carpet should be considered
- Bag and discard the moldy substances
- Allow the area to dry 2 or 3 days
- If flooded, remove all sheetrock to at least 12 inches above the high water mark. Visually inspect the wall interior and remove any other intrusive molds. (This step may have to be carried out by a licensed contractor).

CAUTION: Spores are easily released when moldy material is dried out.

Soap Cleanup

Before disinfecting contaminated areas, clean the areas to remove as much of the mold (and food it is growing on) as possible.

- Wear gloves when doing this cleanup
- Use a non-ammonia soap or detergent, or a commercial cleaner, in hot water, and scrub the entire area affected by the mold
- Use a stiff brush or cleaning pad on block walls or uneven surfaces
- Rinse clean with water. A wet/dry vacuum is handy for this.

Disinfect Surfaces

- Wear gloves when using disinfectants
- After thorough cleaning and rinsing, disinfect the area with a solution of 10% household bleach (e.g., 1½ cup bleach per gallon of water). Using bleach straight from the bottle will not be more effective
- **Never mix bleach with Ammonia - the fumes are toxic**
- For spraying exterior large areas, a garden hose and nozzle can be used
- When disinfecting a large structure, make sure the entire surface is wetted (floors, joists, and posts)
- Avoid excessive amounts of runoff or standing bleach
- Let disinfecting areas dry naturally overnight -- this extended time is important to kill all the mold.

CAUTION: Bleach fumes can irritate the eyes, nose, and throat, and damage clothing and shoes. Make sure the working area is ventilated well.

Can cleaning up mold be hazardous to my health? Yes. Exposure to mold can occur during the cleaning stage. Mold counts are typically 10 to 1000 times higher than background levels during the cleaning of mold damaged materials. Take steps to protect your health during cleanup:

- When handling or cleaning moldy materials, consider using a mask or respirator to protect you

from breathing airborne spores. Respirators can be purchased from hardware stores; select one for particle removal (sometimes referred to as a N95 or TC-21C particulate respirator). Respirators are not as effective removing bleach fumes, so minimize your exposure when using bleach or other disinfectants.

- Wear protective clothing that is easily cleaned or discarded
- Use rubber gloves
- Try cleaning a small test patch of mold first. If you feel that this adversely affected your health, you should consider paying a licensed contractor or professional to carry out the work
- Ask family members or bystanders to leave areas when being cleaned.
- Work over short time spans and rest in a fresh air location.
- Air your house out well during after the work

CAUTION: Never use a gasoline engine indoors (e.g. pressure washer, generator) -- you could expose yourself and your family to carbon monoxide.

Can Air Duct Systems become Contaminated with Mold? Yes. Air duct systems can become contaminated with mold. Duct systems can be constructed of bare sheet metal, sheet metal with an exterior fibrous glass insulation, sheet metal with an internal fibrous glass liner, or made entirely of fibrous glass. If your home's air duct system has had water damage, first identify the type of air duct construction that you have. Bare sheet metal systems, or sheet metal with exterior fibrous glass insulation, can be cleaned and disinfected.

If your system has sheet metal with an **internal** fibrous glass liner, or are made entirely of fibrous glass, the ductwork normally will need to be removed and discarded. Ductwork in difficult locations may have to be abandoned. If you have other questions, contact an air duct cleaning professional, or licensed contractor.

After I've cleaned everything as thoroughly as possible, can I still have mold odors? Yes. It is possible that odors may persist. Continue to dry out the area and search for any hidden areas of mold. If the area continues to smell musty, you may have to re-clean the area again (follow the cleaning steps given in this sheet). Continue to dry and ventilate the area. Don't replace flooring or begin rebuilding until the area has dried completely.

How can further damage to my home be prevented? Check regularly for the following:

- moisture condensation on windows
- cracking of plasterboard
- drywall tape loosening
- wood warping
- musty odor

If you see any of the above, seek out and take steps to eliminate the source of water penetration, as quickly as possible.

Can Ozone air cleaners help remove indoor mold, or reduce odor or pollution levels? Some air cleaners are designed to produce ozone. Ozone is a strong oxidizing agent used as a disinfectant in water and sometimes to eliminate odors. However, ozone is a known lung irritant. Symptoms associated with

exposure include cough, chest pain, and eye, nose, and throat irritation. Ozone generators have been shown to generate indoor levels above the safe limit. Furthermore, it has been demonstrated that **ozone is not effective in controlling molds and fungi,** even at high concentrations far above safe health levels. Also, ozone may damage materials in the home. For these reasons, **the California Department of Health Services strongly recommends that you do not use an ozone air cleaner in any occupied residential space.** Refer to the CDHS IAQ Info Sheet: *Health Hazards of Ozone-generating Air Cleaning Devices* (January 1998).

USEFUL PUBLICATIONS

Biological Pollutants in Your Home, 1990. Available from local ALA or U.S. EPA's IAQINFO. *Concise booklet aimed at concerned or affected homeowner*

Mold, Moisture & Indoor Air Quality: A Guide to Designers, Builders, and Building Owners, 1994. Available from Building Science Corp. (978) 589-5100 or info@buildingscience.com.

Moisture, Mold and Mildew *in Building Air Quality (Appendix C)*, 1991. Available from U.S. EPA's IAQINFO. *Illustrative and useful resource guide*.

Repairing Your Flooded Home. Available from American Red Cross and FEMA offices. *Excellent resource with details on technical & logistical issues.*

Clean-up Procedures for Mold in Houses. Available from Canada Mortgage & Housing Corp. 800-668-2642. *Effective, hands-on information for affected homeowner.*

NIOSH Warns of Hazards of Flood Cleanup Work. National Institute of Occupational Safety and Health (NIOSH) Update. *Aimed at flood emergency workers.* 800-356-4674.

Factsheet on Stachybotrys atra (chartarum). CDHS Environmental Health Investigations Branch, April 1997. *Summarizes information on S.A. and includes NYC recommendations for evaluating and remediating microbial contamination.*

REFERRALS TO OCCUPATIONAL & ENVIRONMENTAL CLINICS

Association of Occupational & Environmental Clinics. 202-347-4976; *http://gilligan.mc.duke.edu/oem/aoec.htm*

American College of Occupational & Environmental Medicine. 847-228-6850; *http://www.acoem.org.*

FOR FURTHER HELP OR INFORMATION:

Contact your County or City Department of Health or Environmental Health

American Red Cross Disaster Response Tel: 213-739-5200 or call local chapter

U.S. EPA's IAQ Information Clearinghouse (IAQ INFO) Tel: 800-438-4318 or 202-484-1307 Phone assistance (9 am to 5 pm, EST) *http://www.epa.gov/iaq/*

CA Department of Health Services

Environmental Health Investigations Branch, 1515 Clay Street, 16th Fl., Oakland, CA 94612, 510-622-4500

Indoor Air Quality Section, 2151 Berkeley Way (EHLB), Berkeley, CA 94704, *www.cal-iaq.org* 510-540-2476

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