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Mold Happens: Dealing with Mold as an Occupational Health Hazard and the Environmental Management of Mold

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Part I: Dealing with Mold as an Occupational Health Hazard Introduction

Bioaerosols are airborne particles derived from microbial, viral and related sources. Human response to bioaerosols can range from innocuous effects (minor eye or respiratory irritation) to serious disease (chronic bronchitis) and depend on the specific agent and susceptibility factors within the person.

Bioaerosols can cause two general conditions: infectious disease such as Legionnaires disease, tuberculosis and allergic reactions such as asthma. Infections are generally the result of growth of microbes inside humans; allergic reactions are the result of exposure to antigens. Sources of airborne antigens include bacteria, fungi, pollen, insect body parts and animal dander. Potential sources of exposure can include water intrusion, open windows, poor housekeeping (dust mites, cockroaches) and household animals.

Molds can be a potential health hazard and can cause allergies, infections and toxicosis due to the ingestion of significant quantities of mycotoxin-contaminated foods such as peanuts (afflatoxins) and bioaerosols within the agricultural industry due to the inhalation of agricultural-based dust.

The mere presence of mold growth does not necessarily indicate that people present in the area will exhibit adverse health effects. However, as the level of mold contaminated materials increases, so do potential exposures. Certain exposures may represent a significant risk such as occupational exposures to high concentrations of fungi and chronic exposures, especially for individuals with pre-existing health conditions such as asthma or allergies.

It is not possible to determine “safe” or “unsafe” levels of exposure for the general public because of variation of individual susceptibility, lack of standardized and validated environmental exposure sampling methods, and lack of reliable biological markers. In addition, there are no established standards for comparing bioaerosol sampling results or an established exposure response relationship.

Mold Prevalence in Office and Buildings

Molds and fungi are common in both indoor and outdoor environments and are important because they decompose organic matter such as dead trees and leaves. As a result, all people have routine exposure to fungi, which is easily transferred from the outdoor environment to the indoor environment by humans. Fungal material will build up on shoes, clothing, personal items, bags and pets. Mold spores can also easily be spread from the outdoors to the indoor environment through open windows, dock doors and ventilation systems. Mold spores continually float through the indoor and outdoor air. It is through these mediums that fungi are transferred from the outdoor environment to the indoor environment (4,5,7).

Molds can grow on virtually any substance, as long as moisture or water, oxygen, and an organic source are present. When mold spores drop on areas where there is excessive moisture, they will grow. They digest whatever they land on in order to survive. There are molds that grow on wood, paper, carpet, foods and insulation, while other molds feast on the everyday dust and dirt that gather in the moist regions of a building (4, 5).

Molds gradually damage building materials and furnishings and even cause structural damage to a wood framed building if left unchecked and moisture continues to be prevalent within the building. While it is impossible to eliminate all molds and mold spores, controlling moisture can control indoor mold growth (4).

Moisture problems within buildings can stem from the original building design such as tightly sealed energy efficient buildings built in the 1970s which resulted in diminished ventilation, contributing to moisture vapor buildup. Other moisture problems within buildings stem from everyday sources such as roof leaks or gutters that direct water into or under a building. Poor maintenance and design of building heating/ventilating/air-conditioning (HVAC) systems, such as insufficient cooling capacity for an air conditioning system, can result in elevated humidity levels in a building (4).

There have been reports linking health effects in office workers to offices contaminated with moldy surfaces and in buildings contaminated with fungal growth. Symptoms, such as fatigue, respiratory ailments, and eye irritation were typically observed in these cases (3).

An office manager or plant manager must be aware of the potential water intrusion sources within their building or office and take immediate steps to address the problem before it results in the growth of mold, which can damage the building and result in potential health effects for the employees that work in the building. Companies today need a formal mold management strategy to address situations such as high humidity levels, minor roof leaks and water intrusion from flooding. Being proactive and solving the problem

before there is visible mold growth and employee complaints is much easier than dealing with the problem after these events take place.

Mold and Respiratory Health

There are only a limited number of documented cases of health problems from indoor exposure to mold. Most typical indoor air exposures to mold do not present a risk of adverse health effects. Molds can cause adverse effects by producing allergens, which can cause allergic reactions. Some individuals within an office or building environment can be more sensitive to molds than other individuals (3,4,).

Individual sensitivities can include nasal stuffiness, eye irritation, wheezing, or skin irritation. Individuals that have serious allergies to molds may have more severe reactions. Severe reactions such as fever and shortness of breath may occur among workers exposed to large amounts of molds in occupational settings, such as farmers working around moldy hay. Individuals with chronic lung illnesses, such as obstructive lung disease, may be particular sensitive to mold and may develop mold infections in their lungs (7, 5).

The Institute of Medicine has found evidence to link indoor exposure to mold with upper respiratory tract symptoms, cough, and wheeze in otherwise healthy people; with asthma symptoms in people with asthma; and with hypersensitivity pneumonitis in individuals susceptible to that immune-mediated condition (5).

Molds grow best in warm, damp, and humid conditions, and spread and reproduce by making spores. Mold spores can survive harsh environmental conditions, such as dry conditions, that do not support normal mold growth. Cladosporium and Aspergillus and common molds found both inside and outside of buildings (4, 5, 7).

Cladosporium is found outdoors on plants and other organic matter. Indoors, Cladosporium is common in the air and on surfaces such as carpet or wallpaper, particularly where moisture is present. Cladosporium rarely cause of human illness, but can cause infections of the skin, eye and sinus. Cladosporium has also been associated with allergies and asthma (8).

Aspergillus is also readily found both inside and outside of buildings and people readily breathe in these spores on a daily basis with no ill effects. Aspergillosis is a disease caused by these spores; however, it usually occurs in people with lung diseases or weakened immune systems. This type of illness can also result in allergic reactions and lung infections (5, 8).

Stachybotrys chartarum is a mold type receives a great deal of press and is often referred to as “black mold” due to its greenish-black color. It is also commonly called toxic mold, which can panic a building owner or homeowner if this type of mold is discovered. Stachybotrys can readily grow on material with a high cellulose and low nitrogen content, such as fiberboard and drywall especially when moisture is present (5, 6).

As with many mold types; excessive growth of Stachybotrys can occur when there is moisture from water damage, excessive humidity, water leaks or flooding. Stachybotrys chartarum and other more common mold types typically requires constant moisture in order to

grow, which is why it is imperative to identify and control water intrusion and water sources to prevent the growth of mold (5).

Mold concentrations outdoors vary greatly with respect to time, species, and amount due to environmental conditions and the particular season. Exposure to excessive amounts of airborne mold outdoors is considered safe for the general public unless the individual has a respiratory condition, allergy or asthma where there may be no practical level of exposure, either indoors or outdoors, that would not create discomfort or harm. The indoor environment usually contains a different variety of bioaerosols than the outdoor environment due to the presence of human bacteria indoors. The outdoor environment usually contains more airborne bioaerosols from environmental sources such as plants and soil (2, 6).

Mold Testing and Air Sampling

Currently, there are no federal standards or recommendations, (e.g., OSHA, NIOSH, EPA) for airborne concentrations of mold or mold spores. Scientific research on the relationship between mold exposures and health effects is ongoing. The Bioaerosol Committee of the American Conference of Governmental Industrial Hygienists (ACGIH) indicates that outdoor airborne fungi concentration typically exceeds 1000 CFU/m^3 and may average approximately 10,000 CFU/m^3 in summer months. No occupational exposure limit for bioaerosols has been promulgated by the Occupational Safety and Health Administration (OSHA). ACGIH also states that concentrations of less than 100 CFU/m^3 may be unhealthy to immunosuppressed people (2, 4, 5, 6).
When conducting Industrial Hygiene air monitoring for common materials and chemicals such as lead, solvents or dust, there are typically Occupational Exposure Levels (OEL) put forth by the Occupational Safety and Health Administration (OSHA) and/or the American Conference of Governmental Industrial Hygienist (ACGIH) to determine if the sampled levels are within or exceed the established OEL. With indoor mold sampling, there are no specific exposure levels by mold type that define either safe or unsafe mold exposure. There have been some Occupational Health and Industrial Hygiene experts that have proposed airborne mold guidelines; however none of these have been adopted by regulatory agencies (2, 4, 5, 6).

Generally, it is not necessary to identify the species of mold growing in a building or office, and the Center for Disease Control (CDC) does not recommend routine sampling for molds. Air monitoring may be necessary if the presence of mold is suspected (i.e. musty odors) but cannot be identified by a visual inspection or bulk sampling (i.e. mold growth behind walls). The purpose of this type of air monitoring is to determine the location and/or extent of contamination. An office or building manager may also receive employee complaints due to visible mold growth and/or health concerns and determine that air monitoring would be beneficial to address these complaints (4, 5, 7).

Air sampling is conducted in areas suspected of having water damage or visible mold growth and samples are also taken outside the sampled building. The proper number and location of air samples is typically based on the comprehensive nature of the study and the cost of the study. Mold levels vary greatly with season, temperature, humidity and time of day. This variability requires that multiple samples be collected at various locations within a building to cross-check sample accuracy to ensure any observed difference is real and not just due to chance (1, 2, 6).

Outdoor counts will vary greatly and may in turn cause similar variation in indoor levels. Because of this variability, it can be difficult to differentiate the exact difference between outdoor and indoor samples without taking a large number of samples. If the results show a greater concentration of mold species inside the building compared to outside the building, then there could be a mold problem within the building, which may indicate on-going water intrusion promoting the growth of mold (1, 2, 6).

Conducting indoor air sampling for mold can help determine if the mold species are similar to the mold species found outside and if the number of colonies are greater or less than the number found outside the building. In general, indoor mold concentrations of a healthy work environment are lower than outdoor concentrations at the same location. If one or more mold species are found indoors, in concentrations greater than outdoor concentrations, then the source of amplification must be found and remedied (2, 3, 6).

If sampling is going to be conducted a sampling plan should be developed by an experienced professional to answer specific questions. The goals and strength of the plan should be determined by qualified individuals prior to proceeding. A laboratory specializing in mycology should be consulted for specific sampling methods, sampling equipment, media and shipping requirements (2, 3, 6).

While testing can be useful to compare indoor and outdoor mold species and counts what to do about mold should be based primarily on a visual assessment of the mold growth, existing water intrusion areas and the history of water damage in the building.

Common Mold Sampling Equipment

There are many methods of assessing mold exposures; all of them have limitations. Further, mold levels within a structure are highly variable and large sample number is required to obtain meaningful data accredited laboratory. Common methods of viable bioaerosol sampling include impactors**,** impingers, and filtration (1, 2).

Impactors utilize the bioaerosol inertia to collect the bioaerosol onto a solid or semi-solid collection medium the impactor forces the air stream to turn a tight corner. If the inertia of the bioaerosol is too great, the bioaerosol will not be able to follow the air flow lines and will instead impact onto the collection medium. Once the bioaerosols are collected onto the collection medium, they can be cultivated to determine the viable count. Multi-stage impactors will use the principle of inertia and can collect a wide range of bioaerosol sizes. The impactor uses inertia to physically collect particles so its physical collection efficiency is highly dependent on particle size and will not capture all of the particles (1, 2)

Liquid impingers allow for longer sampling, which can provide more accurate results. The use of the liquid impinger will reduce particle bounce and collected bioaerosols can be analyzed by a variety of methods. The collection medium for impingers is liquid within a glass bottle (1, 2).

Filters can also be used to sample bioaerosols. Filters use inertia and diffusion to collect particles. Filters have a high physical collection efficiency for a wide range of particle sizes. (1, 2).

The Andersen N-6 Bioaerosol Sampler is a very common sampler for bioareosols. This particular sampler can provide precise mold species identification and can readily identify Aspergillus and Penicillium*,* which are common indoor molds*.* The Andersen sampler along with

the use of agar plates can also identify potentially toxic molds such as Paecilomyces and Fusarium (1).

The results from the Andersen Sampler relate directly to airborne exposures; which allow the industrial hygienist to speciate and specific organisms can be targeted since various types of media are available. The results from using an Andersen sampler along with agar plates can be cross-references with bulk, tape, or swab results in order to find amplification sites (1).

Spore Trap Sampling (Burkard, Allergenco, Air-O-Cell): The Spore trap indoor air quality sampler is a particulate sampling cassette (i.e. Zefon Air-O-Cell Cassette) designed for rapid collection and analysis of a wide range of airborne mold spores. These types of samples are used to detect for total spore counts, which allow the user to compare indoor and outdoor mold spores and counts (1).

Viable Count Impaction Samplers: These devices are handheld units that allow for rapid sampling and analysis of results. They are battery powered and less cumbersome to use during fieldwork. These devices will typically use a median particle size as the basis for the flow rate. Collection efficiency will vary and depends on particle size. Choosing a flow rate based on a particle size can cause an excessive amount of larger particles on the media. This could overestimate total counts based on the variable particle separation rate (1, 2).

Mold sampling can also be accomplished by taking a “grab” or surface sample to determine is if mold is present on surfaces or materials such as walls, carpeting and textiles. Methods of sampling surfaces include tape samples (or tape-lift samples), swab samples, and vacuum samples. As with air samples, guidelines have been offered to help define "normal" levels of mold particles in surface dust. However, these numbers can be misleading and care must be exercised in the interpretation of sample data (6).

Mold Response and Remediation

Moisture control is the key to mold control. When water leaks or spills occur indoors, the situation should be immediately addressed within 24 to 48 hours. A response to water intrusion should involve a thorough clean up, drying, and/or removal of water damaged materials to prevent or limit mold growth. Remediation includes both the identification and correction of the conditions that permit mold growth, as well as the steps to safely and effectively remove mold-damaged materials. Any remediation plan must include steps to permanently correct the water or moisture problem as its top priority (3, 4, 6).

Effective communication with building occupants is an essential component of all large-scale remediation efforts. Management should notify employees in the affected area(s) of the presence of mold. Notification should include a description of the remedial measures to be taken and a timetable for completion. Periodic updates should be provided to employees indicating progress on the remediation efforts and future plan activities (4).

If a business is planning on using in-house personnel (remediators) to clean up small or mid-sized areas of mold damage they should develop a formal mold remediation program and designate an individual as a remediation manager. The remediation manager's highest priority must be to protect the health and safety of the building occupants and remediators. A remediation

program should include these basic elements; employee training (proper cleanup methods, personal protection, and potential health hazards), the use of personal protective equipment such as respiratory protection (e.g., N95 disposable respirator), a respirator program in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), the use of gloves and eye protection. The remediation program must also include training and measures to prevent mold and mold spores from being dispersed throughout the air where they can be inhaled by building occupants. In some cases, especially those involving large areas of contamination, the remediation plan may call for the use of plastic to contain areas and control dust and the temporary relocation of some or all of the building occupants (3, 4, 6).

The primary reasons for relocating employees largely depends upon the size of the area that has been affected by the mold growth and the type and extent of health effects reported by the employees. In addition, before deciding to relocate employees, one should also evaluate the remediator's ability to contain the spread of mold spores given the parameters of the workspace and the areas affected by mold growth. A business also has to consider the amount of disruption relocating the employees is likely to cause. When possible, remediation activities should be scheduled after normal work hours when employees and sensitized individuals are less likely to be affected (3, 4, 6).

In house employees designated as remediators should be medically cleared before working on mold remediation or investigating potentially moldy areas. If a large area is being remediated, dust may be generated and the use of a respirator may be required. Remediation plans may vary greatly depending on the size and complexity of the job, and may require revision if circumstances change or new facts are discovered. Small and mid-sized areas would be classified as between ten and thirty square feet and include the cleaning of ceiling tiles, walls and individual wallboard panels (3, 6).

Contaminated areas in excess of one hundred square feet, which require remediation would mandate more extensive evaluation, repair or replacement, and dust control. Professional assistance may be required to assess the situation and to clean up and/or remove the mold. If a company decides to hire outside assistance to do the cleanup, they need to ensure that the contractor has experience with mold remediation. As in any business, it is important to ask for a statement of qualifications and a client reference list. Asking to see evidence of professional development, participation in professional organizations and obtaining customer references is also appropriate. The contractor should be familiar with the recommendations in EPA's publication, "Mold Remediation in Schools and Commercial Buildings," or other guidelines. There are currently no national or state recognized mold certifications. There are a number of credentialing programs that provide evidence of health and safety competency including the American Board of Industrial Hygiene and American Society of Safety Engineers (3, 4, 6).

Mold Clean Up

After the source of moisture has been controlled, visible mold growth on hard (non-porous) can be scrubbed using detergent and water. Some stains may still be seen on the surface after cleaning. Various strengths of bleach solutions have also been recommended for disinfecting, but proper safety precautions should be taken to prevent skin, eye and respiratory damage when bleach is used. Building materials supporting fungal growth must be remediated as rapidly as possible in order to ensure a healthy environment (3, 4).

Small amounts of mold growing on visible surfaces can usually be easily cleaned by using household cleaners or bleach. Exposure to dust during the clean-up process should be avoided or specific personal protective equipment or ventilation controls should be used to eliminate the dust exposure. If the cleaning process creates dust care must be taken to control dust related to the cleaning and repair efforts. (3, 4, 6,)

Wet vacuums should be used to remove all standing water from floors, carpets, and hard surfaces where water has accumulated. They should not be used to vacuum porous materials, such as drywall or gypsum board. Wet vacuums should be used only on wet materials, as spores may be exhausted into the indoor environment if insufficient liquid is present. Dust generated from cleaning efforts can quickly contaminate the air and spread throughout the building and into the ventilation system. Dust created from any cleaning effort should be controlled using damp cleaning methods (use of water, cloth and detergent or bleach) and by using a vacuum, which has a High Efficiency Particulate Air (HEPA) filter. A standard home use vacuum typically has filters which will not capture spores as efficiently as a HEPA filter and can further spread mold spores in the air (4, 6).

There have been some questions raised regarding the use of ozone generators for mold control. Ozone generators can create a serious health hazard in occupied spaces and should not be used for mold control. Ozone is considered toxic to living cells and is irritating to the eyes, nose, throat and lungs and can aggravate asthma. Ozone generators do not remove allergens from air. In addition, ozone generators or other types of air cleaning devices do not address the underlying reason why mold is growing within a building and does not remove visible mold growth (6).

If a HVAC system is contaminated with mold or if mold is present near the intake to the system, the systems should be temporarily shut down as it could spread contamination throughout the building. In this situation, a business should consult with a professional HVAC contractor. If the water or mold damage was caused by sewage or other contaminated water, consult a professional who has experience cleaning and repairing buildings damaged by contaminated water (4).

Part I: Summary

All molds should be treated the same with respect to potential health risks. After correcting water intrusion or excessive moisture, the prompt removal of contaminated material and structural repair is the primary response to mold contamination in buildings. In all situations, the underlying cause of water accumulation must be identified and controlled or the mold growth will continue. Emphasis should be placed on preventing contamination through proper building and HVAC system maintenance and prompt repair of water-damaged areas.

If a building has had water intrusion, high humidity or other conditions that promote the growth of mold (bioaerosol products), air sampling and analysis of the environment can help determine if these bioaerosol particles are present and if they represent a significant health concern. The air sampling allows a safety manager to determine if the bioaerosol particles are unique to the indoor environment or exist at higher levels than those levels within the outside environment.

Individuals with persistent health problems that appear to be related to mold 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.

Part 2: Environmental Management of Mold

Mold can be found naturally outdoors and indoors. Moisture can be present in buildings or building materials. If not discovered or addressed promptly, moisture can lead to mold growth. Uncontrolled mold growth can be a very serious issue for Property Managers. A variety of conditions – including excessive humidity, plumbing leaks, condensation in poorly ventilated areas, defective construction, or flooding – can be source of mold problems. If left unaddressed, the mold growth has the potential to cause health effects, structural damage, and/or costly repairs. A Property Manager can defend against problems associated with mold and water intrusion damage by implementing a plan that focuses on four prevention factors:

- *Planning*: The Property Manager needs to instill mold awareness for employees and building occupants. Managing moisture, water intrusion, and mold requires proactive planning by the Property Manager, property staff, and tenants. Employees, for example, must be aware of conditions that can facilitate moisture problems and mold growth, and should know when to report mold or water intrusion conditions.
- *Communicating* –Communication about mold and moisture control prevention and response is critical to developing good management/tenant relationships, as well as to encourage supporting staff response activities.
- *Monitoring* – Preventative maintenance and routine inspection of building systems (i.e., the building envelope, rook, windows, and HVAC system components) can identify and prevent chronic moisture conditions, low level leaks or water intrusion. The Property Manager ensures that periodic inspections and maintenance activities are conducted. Generally, these activities are performed in conjunction with other planned preventative maintenance or inspection protocols for buildings.
- *Responding* – The Property Manager should have a clear path to take when water intrusion or mold growth is discovered at his buildings. Generally speaking, the Property Manager will determine what actions to take, when to take them, and who will perform the actions when water intrusion or mold growth occurs.

From an environmental standpoint, a property manager must accept the reality that "mold happens" and set a course to prepare a mold management strategy. To that end, Property Managers frequently develop and use a "Mold and Moisture Control Maintenance Plan" (hereinafter referred to as the "Mold Plan") to raise awareness, prevention, recognition, and management of moisture control and mold growth at their facilities. The Mold Plan can provide procedures for inspecting and maintaining buildings to reduce the potential for mold related incidences, as well as a framework to manage water intrusion events and mold remediation. Guidelines for communication, documentation, and training are also essential attributes of a Mold Plan. By using a Mold Plan, the Property Manager is taking steps to reducing property loss and environmental loss potential.

Important Attributes of the Mold and Moisture Control Plan

An effective Mold Plan will follow a general framework that anticipates conditions that contribute to mold growth and prescribes response activities in the event of a water intrusion or mold growth event. Provided below is a brief summary of common elements of a Mold Plan.

The Plan's Author

Generally speaking, most Property Managers do not have the specialized technical training to develop a company's Mold and Moisture Control Plan. An environmental professional, such as a Professional Engineer (PE) or Certified Industrial Hygienist (CIH), should be hired by the Property Manager his company to prepare the Mold Plan. When selecting the environmental professional to develop the plan, the Property Manager should validate that the environmental professional's credentials are sufficient and relevant. At a minimum, the environmental professional should be familiar with regulator guidelines, laws, or professional standards. In general, the selection of the environmental professional is made by the Property Manager. However the Property Manager must confirm that outside consultants or contractors are approved by the Property Owner.

Defining Key Personnel and Responsibilities

Continuous preventative maintenance and successful response to water intrusion events requires planning, coordination, and communication between all people involved in management of property. Clear directions and designation of duties should be spelled out in the Mold Plan.

The Property Manager would be responsible for overseeing the Mold and Moisture Control Plan. The Property Manager will have the authority to allocate resources where needed, and provide guidance and approval of necessary response actions to water intrusion or mold growth within the building. The Property Manager's responsibilities include but are not limited to the following:

- Communicating the Mold Plan to maintenance and housekeeping staff, as well as contractors hired to work in the building(s).
- Scheduling inspections and routine maintenance.
- Investigating complaints or reports of water intrusion or visible microbial growth.
- Planning response actions in the event of water intrusion or mold growth
- Provide Health and Safety Training for Maintenance and Housekeeping staff and maintain inventory of PPE (respirators, gloves, etc.)
- Determining who performs clean up or repairs (either by in-house staff or outside remediation contractor).
- Monitoring clean up or repairs to ensure procedures and actions taken are consistent with the Mold Plan.
- Maintaining documentation.

The Mold and Moisture Control Plan would also specify the roles and responsibilities of the Building management team and tenants. Table 1, listed below, provides a summary of general expectations of the Maintenance Supervisor, Maintenance Staff, and Tenants.

General Responsibility	*Maintenance Supervisor*	*Maintenance Staff*	*Tenant*
Document and promptly follow up on work orders related to water infiltration.	☑		
Act as building liaison with building tenants to address potential questions and concerns	☑		
Overseeing operations of remediation contractors	☑		
Coordinate response and elimination of moisture problems,	☑		
Ensure Health and Safety of workers and tenants during activities	☑	☑	
Implement and document periodic and routine inspections outlined in this Program	☑	☑	
Receive Training on mold recognition and response procedures	☑	☑	☑
Conduct routine Inspections	☑	☑	
Perform supervised Mold response or assist in larger clean-ups	☑	☑	
Report unusual Odors or potential signs of mold growth	☑	☑	☑
Report Discovery of Water Intrusion	☑	☑	☑

Table 1. General Responsibilities of Maintenance Supervisor, Personnel, and Tenants

Procedures to Maintain Documentation and Records

Record keeping and maintenance is vital to the Property Manager's oversight of mold-related activities. Most Mold Plans provide template documents (i.e., letters), forms, or checklists that can be used to ensure consistent actions by the property staff. The records also ensure that accurate tracking of activities taken during a response to a water intrusion incident or mold cleanup. These activities can include inspections, maintenance events, sampling, tenant complaints, response actions, and follow-up.

Mold Plans will provide building plans (drawings), checklists or boilerplate documents for inspections, correspondence, or other record-keeping needs. Documentation that a Property Manager should maintain can include but is not limited to:

- Monthly Building Inspection Checklist
- Maintenance Inspection Chart
- Building Plans, (including plumbing and HVAC schematics)
- Indoor Air Quality Complaint Form
- Incident Report Log or Mold Remediation Checklist
- Complaint Response Documentation (investigations conducted, and response actions taken)
- Sample tenant Follow-up Letter

All original records shall be maintained at the Property Manager's office or another area designated by the property owner. In cases where multiple buildings are managed the records should be filed by property address. The documentation should be retained for a specified period (usually at least five years) as recommended by the Environmental Professional or as required by law (which ever is longer).

Preventative Inspections and Maintenance Protocol

Routine inspection and maintenance of HVAC systems and other building systems (e.g. roof or building envelope) is important to identifying and preventing chronic moisture conditions, low level leaks, or water intrusion. Moisture control inspections and maintenance activities are often scheduled concurrent with other planned building maintenance actions. In general, the following areas will require periodic inspections and preventative maintenance:

- *HVAC System Maintenance and Inspections*: Building HVAC systems distribute air-conditioning and heating systems to multiple areas, including common spaces, meeting rooms, administrative offices, kitchens, and laundry and storage areas. Poor filter maintenance is a common example of inadequate preventive maintenance. Filters that are not changed regularly can become media for growth, sometimes allowing particles or microorganisms to be distributed within the HVAC system and building.
- *Building Envelope Inspections:* Common building envelope components that can cause water intrusion events include roofing (e.g., penetration leaks, clogged roof drains, excessive ponding, or snow buildup over flashing), exterior caulking (e.g., windows, doors, expansion joints), and poor site drainage around the exterior perimeter of the building. Cold surfaces, such as poorly insulated roof drains, windows, and concrete slab on grade construction are common sources of condensation.

Guidelines for Responding to Water Intrusion and Remediating Mold

The Mold Plan's inspection, maintenance and communications protocol should anticipate potential scenarios and spell out response actions to take in the event of a water intrusion event, mold growth, or tenant complaint. When water intrusion or mold growth is identified, the Mold Plan will specify what appropriate action must be taken to expedite remediation. General guidelines include the following steps:

- *Incident Reporting* - An Incident Report should be a boilerplate document that provides basic information related to the situation, including Identified location of water intrusion or visible mold growth, estimated size of the affected area (square footage), areas affected an source of water intrusion (if identifiable), and initial steps taken.
- *Implementing the Response* - Fixing the underlying cause of water intrusion reduces the potential for mold growth recurrence. Any water infiltration into the building envelope should be eliminated and cleaned immediately. Emphasis should be on quick response to ensure permanent repairs. The size of the impacted area will may dictate who performs the response, what clean-up method to utilize, and what degree of personnel protective equipment (PPE) to use.
- *Monitoring the Response* – Documenting and overseeing the response is crucial to the response. The Property Manager should ensure that records are kept of the initial conditions, actions taken, and personnel involved, including the name of individual or company retained to perform drying or clean-up activities, the start date for cleanup, the name of air quality testing company (if used), and date testing was performed.

- *Closeout Reporting* - When the response is completed, closeout documentation should be compiled. This includes a summary of actions taken, remediation completion date, air quality analytical report(s), photographic documentation of remediated areas, and follow-up correspondences with building tenants.

The Mold Plan should reference generally accepted industry guidelines pertaining to assessment and remediation of mold impacts, including:

- USEPA *Mold Remediation in Schools and Commercial Building* (March 2001);
- New York City Department of Health (NYCDOH), *Guidelines and Assessment of Remediation of Fungi in Indoor Environments* (Updated 2000);
- American Industrial Hygiene Association (AIHA), *Guideline 3: Assessment, Remediation, and Post-Remediation Verification of Mold in Buildings* (July 2004)

When mold growth is discovered, the size of the mold impact may dictate the remedial measures to take. In general, there are three or four categories of mold impact (by area):

EPA's guideline designates areas of mold impacts as:

Small (<10 square feet),
Medium (between 10 square feet and 100 square feet) and
Large (> 100 square feet)

Similarly the NYCDOH guideline designates areas of mold impacts as:

Level 1: (10 square feet or less);
Level 2: (10-30 square feet);
Level 3: (greater than 30 square feet); and
Level 4: (Remediation of HVAC Systems).

Porous materials that experience mold growth, such a gypsum board ceiling tiles, or insulation would generally be removed and discarded. Some materials can be re-used, but only after cleaning, drying, and inspection. Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are not structurally damaged and are visibly mold-impacted can be cleaned and reused. Cleaning should be done using a detergent solution. The Property Manager should ensure that inspections are conducted to confirm the completion and effectiveness of the remediation work.

The American Conference of Governmental Industrial Hygienists (ACGIH) does not recommend using gaseous, vapor-phase, or aerosolized biocides. The use of biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space if used improperly

Part 2: Summary

Control of moisture, water intrusion, or mold growth is unceasing responsibility for a Property Manager. If not discovered or addressed promptly, moisture can lead to mold growth. If a Property Manager does not have a plan or procedures to inspect for, or respond to moisture and/or

mold growth at a property, uncontrolled mold growth may result. The implications of uncontrolled mold growth in building space can be a very serious issue for Property Managers. The cost to clean-up small impacted areas may be manageable. Larger clean-ups, which can include structural damage, can be time consuming and costly. The potential for bodily injury damages also increases substantially if the Property Manager does not prepare a plan to address moisture, water intrusion, or mold growth in building spaces. A Property Manager can defend against uncontrolled mold by preparing and implementing a Mold and Moisture Control Maintenance Plan. Mold Plans give the Property Manager the ability to anticipate and plan for moisture conditions, communicate mold awareness to workers and tenants, schedule inspection and maintenance activities, and respond properly to conditions when water intrusion or mold growth occurs. When used properly, the Mold Plan can limit water damages to the building, minimize clean-up costs, and reduce the potential for bodily injury.

NOTE: This informational paper is necessarily general in content and intended to provide an overview of certain aspects of Mold and Moisture Control Maintenance Planning. This document is advisory in nature and is for informational purposes only. No liability is assumed by reason of the information this document contains. The information provided should not be relied upon as legal advice or a definitive statement of the law in any jurisdiction. For such advice, a listener or reader should consult their own legal counsel.

Endnotes

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