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NEW YORK STATE DEPARTMENT OF LABOR
MOLD TRAINING PROGRAM

MOLD ASSESSOR INITIAL

TABLE OF CONTENTS

NYS Labor Law Article 32

1

NYS Article 32

- Signed by Governor January, 2015
- Establishes certification and licensing program with fees
- Provides for accreditation of training providers
- Establishes standards for assessment & remediation
- Defines practices & procedures

2

NYS Article 32

- Enforced by NYS Dept of Labor Division of Safety & Health
- Assigns Roles & Responsibilities
  - Mold Assessor
  - Mold Remediation Contractor
  - Mold Abatement Supervisor
  - Mold Abatement Worker

3

NYS Article 32

The Mold Remediation Plan Must Specify:

- The Rooms Or Areas Where The Work Will Be Performed;
- The Estimated Quantities Of Materials To Be Cleaned Or Removed;
- The Methods To Be Used For Each Type Of Remediation In Each Type Of Area

4

NYS Article 32

The Mold Remediation Plan Must Specify:

- The PPE To Be Supplied By Licensed Remediators For Use By Licensed Abaters;
- The Proposed Clearance Procedures And Criteria For Each Type Of Remediation In Each Type Of Area;
- Occupant Notification

5

NYS Article 32

The Mold Remediation Plan Must Specify:

- Recommendations For Notice And Posting Requirements
- An Estimate Of Cost And An Estimated Time Frame For Completion;
- When Possible, The Underlying Sources Of Moisture That May Be Causing The Mold And A Recommendation As To The Type Of Contractor Who Would Remedy The Source Of Such Moisture.

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NYS Article 32

Disinfectants, Biocides And Antimicrobial Coatings May Be Used Only If Their Use Is Specified In A Mold Remediation Plan, If They Are Registered By The United States Environmental Protection Agency For The Intended Use And If The Use Is Consistent With The Manufacturer's Labeling Instructions.

7

Mold Remediation Work Plan NYSDOL

- A licensed Mold Remediation Contractor will utilize the information provided by the Mold Assessment Consultant in the *Mold Remediation Plan* and generate a *Mold Remediation Work Plan* specific to each project.
- The Work Plan must fulfill all the requirements of the mold remediation plan developed by the Mold Assessment Consultant as provided to the client and provide specific instructions and/or standard operating procedures for how a mold remediation project will be performed.

8

NYS Article 32

Post-remediation Assessment And Clearance

- Determine Whether The Work Area Is Free From All Visible Mold
- All Work Has Been Completed In Compliance With The Remediation Plan And Remediation Work Plan Meets Clearance Criteria Specified In The Plan.

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NYS Article 32

Post-remediation Assessment And Clearance

- Post-remediation Assessment Shall Determine That The Underlying Cause Of The Mold Has Been Remediated So That It Is Reasonably Certain That The Mold Will Not Return From That Remediated Area.
- If It Has Been Determined That The Underlying Cause Of The Mold Has Not Been Remediated, The Mold Assessment Licensee Shall Make A Recommendation To The Client As To The Type Of Contractor Who Could Remedy The Source Of The Mold Or The Moisture Causing The Mold.
- A Mold Assessment Licensee Who Determines That Remediation Has Been Successful Shall Issue A Written Passed Clearance Report To The Client At The Conclusion Of Each Mold Remediation Project.

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NYS Article 32

EXEMPTIONS

- A Residential Property Owner Who Performs Mold Inspection, Assessment Or Remediation On His Or Her Own Property;
- A Non-residential Property Owner, Or The Employee Of Such Owner, Who Performs Mold Assessment Or Remediation On An Apartment Building Owned By That Person That Has Not More Than Four Dwelling Units
- An Owner Or A Managing Agent Or A Full-time Employee Of An Owner Who Performs Mold Assessment Or Remediation On Commercial Property Owned By The Owner Provided
  - Does Not Apply If The Managing Agent Or Employee Engages In The Business Of Performing Mold Assessment Or Remediation For The Public.

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NYS Article 32 FAQs

What is a Mold Project?

A Mold Project is defined as mold remediation, mold assessment, or mold abatement, of areas greater than ten (10) square feet undertaken for purpose of mold remediation or abatement. It does not include:

- routine cleaning, or
- construction, maintenance, repair or demolition of buildings, structures or fixtures undertaken for purposes other than mold remediation or abatement.
- The mere presence of mold does not trigger any obligation to obtain an assessment or perform remediation. However, if a property owner does elect to hire either an assessor or remediator, for the purposes of mold assessment or remediation, those individuals must be licensed and follow the requirements in the law.

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NYS Article 32 FAQs

Who is required to obtain a Mold Assessor License?

Any business that:
- engages in mold assessment on a project,
- advertises that it is a mold assessment company, or
- holds itself out as a mold assessment company.

AND any individual who inspects or assesses property for the purpose of discovering:
- mold,
- conditions that facilitate mold, and/or
- any conditions that indicate they are likely to encourage mold.

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NYS Article 32 FAQs

Who is required to obtain a Mold Remediation Contractor License?

Any business engaged in mold remediation. Mold remediation is defined as the business of removal, cleaning, sanitizing, or surface disinfection of mold, mold containment, and waste handling of mold and materials used to remove mold from surfaces by a business enterprise, including but not limited to, sole proprietorships.

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NYS Article 32 FAQs

Who is required to obtain a Mold Abatement Worker Supervisor License?

Individuals who draft Mold Remediation Work Plans and serve as mold site or project supervisors. Mold abatement is defined as the act of removal, cleaning, sanitizing, or surface disinfection of mold, mold containment, and waste handling of mold and materials used to remove mold from surfaces by an individual.

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NYS Article 32 FAQs

Who is required to obtain a Mold Abatement Worker License?

Any individual engaged in mold abatement. Mold abatement is defined as the act of removal, cleaning, sanitizing, or surface disinfection of mold, mold containment, and waste handling of mold and materials used to remove mold from surfaces by an individual.

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NYS Article 32 FAQs

Are there any exemptions from these licensing requirements?

Yes, the following persons/entities are not required to obtain a license in order to perform mold assessment, remediation, or abatement:
- A residential property owner who performs mold inspection, assessment, remediation, or abatement on his or her own property;
- A non-residential property owner, or the employee of such owner, who performs mold assessment, remediation, or abatement on an apartment building owned by that person where the property has four or less dwelling units;
- An owner or a managing agent or a full-time employee of an owner or managing agent who performs mold assessment, remediation, or abatement on commercial property or a residential apartment building of more than four dwelling units owned by the owner. This exemption will not apply if the managing agent or employee engages in the business of performing mold assessment, remediation, or abatement for the public; and
- A federal, state or local governmental unit or public authority and employees thereof that perform mold assessment, remediation, or abatement on any property owned, managed or remediated by such governmental unit or authority.

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NYS Article 32 FAQs

Are agents (Consultants and/or Contractors) of a governmental unit or public authority exempt from the licensing requirement in Article 32?

No. The exemption only applies to federal, state or local governmental units, public authorities and their employees.

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NYS Article 32 FAQs

Can a licensed mold remediator perform work on a project for a client without an assessment from a licensed mold assessor?

No. Labor Law Article 32 Section 946 (1) provides that a licensed mold remediator cannot perform work on a project without an assessment performed by a licensed assessor. Before beginning site preparation work, the law requires that a licensed remediator:

- obtain a copy of the licensed mold assessor's mold remediation plan from the client;
- prepare a mold remediation work plan ("work plan") that fulfills all of the requirements of the licensed assessor's mold remediation plan; and
- provide a copy of the newly prepared "work plan" to the client.

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NYS Article 32 FAQs

May individuals who hold current mold certifications or licenses in other states perform mold projects under their current certifications or licenses?

Not at this time. Exemptions from licensing are provided in the New York State Labor Law Article 32 Section 931 5(a) and 5(b), and Section 933. Individuals not covered under these exemptions are required to take and successfully pass course(s) offered by Department-approved training course providers and must also be licensed by the Department of Labor.

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NYS Article 32 FAQs

Can a licensed mold remediator also perform the assessment on the same project?

No. Labor Law Section 936 (2), states that no licensee shall perform both mold assessment and mold remediation on the same project. If the licensed mold remediator on a project engages in assessment conduct that would otherwise be performed by a licensed mold assessor on that project, the licensed mold remediator has violated Section 936 of the Labor Law. This includes the practice of providing the client with a "fill-in-the-blank" assessment form.

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NYS Article 32 FAQs

Can a licensed mold remediator perform work on a project without an assessment if the owner of the home or property provides a waiver?

No. The Labor Law does not allow a licensed mold remediator to perform work on a project without an assessment from a licensed mold assessor. In addition, Labor Law Section 936 prohibits a licensee from performing both the mold assessment and the mold remediation on the same project.

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Factsheet

- Mold Assessment & Remediation Factsheet
- FAQs & Answers for Consumers

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Complaint Form

- DOL Mold Contractor Complaint Form
- Used to investigate violations of Article 32 of the New York State Labor Law

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Guidance Documents

- New York City Department of Health and Mental Hygiene "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" – 2008
- EPA Mold Remediation in Schools and Commercial Buildings – 2008
- OSHA "Brief Guide to Mold in the Workplace" – 2013
- Institute of Inspection, Cleaning and Restoration Certification (IICRC) S520

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NYS Mold Training
Hazard Communication

1

Hazard Communication

The basic goal of a Hazard Communication Program is to be sure employers and employees know about work hazards and how to protect themselves; this should help to reduce the incidence of chemical source illness and injuries.

2

HAZCOM . . .

OSHA has estimated that more than 32 million workers are exposed to 650,000 hazardous chemical products in more than 3 million American workplaces.

- Does this pose a serious problem for exposed workers and their employers …?
- What do you think?

3

What Does The HAZ COM Standard Do?

The HCS provides workers the right-to-know concerning the hazards and the identities of the chemicals they are, or may have the potential to be, exposed to in the workplace.

4

Steps to an Effective HAZ-COM program

- Hazard Assessment
- Develop a written HAZCOM Plan
- Appointment of a HAZCOM Coordinator
- Conduct the chemical inventory
- Initiate labeling requirements
- Maintain the SDS library
- Establish employee training

5

General Information

- Effective May 23, 1988, OSHA regulations require that employees be made aware of hazardous substances in the workplace.
- In general, each employee should be appraised of the hazardous properties of chemicals that they may encounter along with measures to take to protect themselves from these chemicals.

6

Hazard Determination

- The standard requires that employers inventory all hazardous chemicals in the workplace and include that inventory as a part of the written hazard communication program.
- This inventory will eventually serve as a master list for which a SDS must be obtained and maintained.

7

What Are Some Of The Hazardous Materials?

Explosives
Gases
Flammable Liquids
Flammable Solids
Oxidizers

Organic Peroxides
Toxic Materials
Infectious Substances
Radioactive Materials
Corrosive Materials


8

Flammable Liquids

- Includes combustible liquids [U.S.]
  - Solvent Based Paints
  - Mastics & Adhesives
  - Pipe Joint Compounds
  - Sealant
  - Cleaning Solvents
  - Glues
  - Paint Strippers

9

Oxidizing Substances & Organic Peroxide

- Division 5.1 Oxidizers - A substance that yields oxygen readily to stimulate the combustion of certain other substances.
- Division 5.2 Organic Peroxides - A derivative of hydrogen peroxide in which part of the hydrogen has been replaced by an organic peroxide

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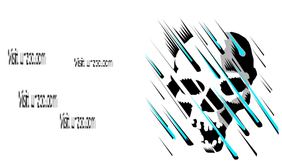
Toxic Materials

- Division 6.1 Toxic Materials
- Division 6.2 Infectious Substances



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Corrosive Materials

- A liquid or solid that causes visible destruction or irreversible damage to skin tissue at the point of contact, pH that has a severe corrosion rate on steel
- Similar to RCRA corrosive definition but does not include specific pH thresholds

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HAZCOM Coordinator

Responsible for Meeting OSHA Requirements

- Chemical Inventory
- Labelling
- Employee Training
- Hazard Analysis

13

Conduct The Chemical Inventory

Explosives	Organic Peroxides
Gases	Toxic Materials
Flammable Liquids	Infectious Substances
Flammable Solids	Radioactive Materials
Oxidizers	Corrosive Materials

14

Initiate Labeling Requirements

In-plant containers of hazardous chemicals must be labeled, tagged, or marked with the identity of the material and appropriate hazard warnings.

15

Safety Data Sheet (SDS)

- Chemical manufacturers and importers are required to obtain or develop a safety data sheet for each hazardous chemical they produce or import. Distributors are responsible for ensuring that their customers are provided a copy of these MSDSs. Employers must have an MSDS for each hazardous chemical which they use.*

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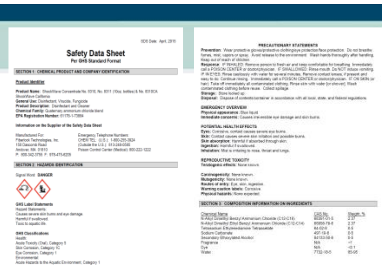

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Establish EmployeeTraining

Each employee who may be "exposed" to hazardous chemicals when working must be provided information and trained prior to initial assignment to work with a hazardous chemical, and whenever the hazard changes.

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Employee Responsibilities

- Know where to get information about hazardous substances used, stored, or handled at your inspection sites.
- Learn to read labels and understand SDSs.
- Identify hazards before you begin a task.
- Do not be afraid to ask questions.
- Use personal protective equipment.

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Non-Routine Tasks

Supervisors should ensure that employees are informed of potential chemical, biological, and physical hazards associated with the performance of any non-routine tasks along with appropriate personal protective measures.

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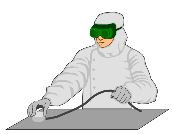
Determination of Hazards and Personal Protective Equipment

Job Hazard Analysis
Activity Hazard Analysis
Job Safety Analysis



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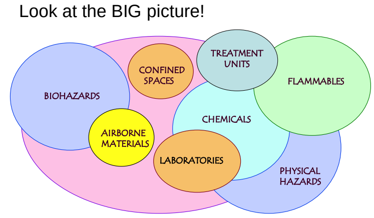
Hazard Recognition

Look at the BIG picture!



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HAZCOM Summary

Protection under OSHA's HAZCOM Standard (HCS) includes all workers exposed to hazardous chemicals in all industrial sectors. This standard is based on a simple concept - that employees have both a need and a right to know the hazards and the identities of the chemicals they are exposed to when working. They also need to know what protective measures are available to prevent adverse effects from occurring.

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Protecting the Public & Occupants

1

Protecting the Public

- The remediation plan should cover the use of appropriate personal protective equipment (PPE) for the safety of workers
- It also should include steps to carefully contain and remove moldy building materials in a manner that will prevent further contamination.

2

Protecting the Public

- 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.

3

Protecting the Public

- The remediation manager's highest priority must be to protect the health and safety of the building occupants and remediators.
- Remediators should avoid exposing themselves and others to mold-laden dusts as they conduct their cleanup activities

4

Protecting the Public

- The demarcation of established remediation areas should be done utilizing signs, barrier tape and notifications to ensure exposures to mold is minimized to occupants and the general public

5

Occupant Relocation

- Use caution to prevent mold and mold spores from being dispersed throughout the air where it can be inhaled by building occupants.
- In some cases, especially those involving large areas of contamination, the remediation plan may include temporary relocation of some or all of the building occupants

6

Occupant Relocation

- When deciding if relocating occupants is necessary, consideration should be given to the size and type of mold growth, the type and extent of health effects reported by the occupants, the potential health risks that could be associated with the remediation activity, and the amount of disruption this activity is likely to cause.
- In addition, before deciding to relocate occupants, one should also evaluate the remediator's ability to contain/minimize possible aerosolization of mold spores given their expertise and the physical parameters of the workspace. When possible, remediation activities should be scheduled during off hours when building occupants are less likely to be affected.

7

Protecting the Public

"Remediation Planning" (video)

8

NYSDOL MOLD TRAINING

Workplace Hazards

1

Workplace Hazards

- Situational Awareness
- Fire / Explosion
- Slips, Trips and Falls
- Medical Emergencies
- Drugs and Alcohol Use
- Ladder Safety
- Poor Lighting
- Confined Spaces
- Noise
- PPE
- Electrical
- Chemicals
- Asbestos
- Lead Paint

2

Other Hazards

- Sharp objects
- Slippery surfaces
- Falling objects
- Terrain
- Unstable surfaces
- Burns
- Improper lifting
- Heavy Equipment
- Pinch points
- Environmental (weather, animals, poisonous plants)
- Struck-by / Roll Over
- Public/Other Contractors
- Dehydration
- Ergonomic hazards

3

Work Place Hazards

OSHA's Hierarchy of Controls

4

Most Common Injuries

- Cuts and burns are the most common injuries on abatement projects. These are usually not required to be reported to OSHA
- The most common OSHA reportable injuries are the result of slips, trips and falls

5

Situational Awareness

- Paying attention to what you're doing and to your surroundings.
- Not being pre-occupied or daydreaming while at the work site.

6

Personal Protective Equipment

- 29 CFR 1910.132
- “Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices…shall be provided, used and maintained whenever it is necessary by reason of hazards of processes or environment… capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.” - OSHA

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Protective Clothing

- Protective Clothing
- Hoods and boots
- Respirator inside of hood
- Oversize suits for ease of movement
- Reinforce suits with duct tape
- Tape wrists to gloves, ankles

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Respiratory Protection

- Respirators are the last option after:
  - engineering controls
  - administrative controls
  - work practices
  - alternative materials
  - other methods

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NIOSH

NIOSH Recommendation:

"Respiratory protection may be necessary for certain operations or methods such mold removal and paint removal by chemicals, heat gun, or abrasive techniques, and some set-up, and cleaning operations. However, respirators are the least preferred method of controlling airborne Mold exposure, and **they should not be used as the only means of preventing or minimizing exposures. Respiratory protection requirements are not an acceptable substitute for adequate training, supervision, appropriate engineering controls, and environmental or medical monitoring.** Initial respiratory protection requirements for abatement work (which may be based on conservative assumptions) should be modified with appropriate job-specific requirements based on air monitoring results. Respirator selection for each job category at every worksite should be determined by an industrial hygienist or other qualified individual, based on maximum airborne exposures measured."

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Types of Respirators

- Three levels of particulate filter efficiency are 95%, 99%, and 99.97%. The three categories of resistance to filter efficiency degradation are labeled N, R, and P. The class of filter will be clearly marked on the filter, filter package, or respirator box.

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Types of Respirators

- Half Face Negative Pressure
- N100 Fitted Facepiece
- N95 Fitted Facepiece
  (i.e. dust mask)

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Types of Respirators

- **Filter Efficiency** - selection of filter efficiency (i.e., 95%, 99%, or 99.97%) depends on how much filter leakage can be accepted. Higher filter efficiency means lower filter leakage.
- **Oil Resistance** - selection of N-, R-, and P-series filters depends on the presence or absence of oil particles, as follows: If no oil particles are present in the work environment, use a filter of any series (i.e., N-, R-, or P-series).
  - If oil particles (e.g., lubricants, cutting fluids, glycerine, etc.) are present, use an R- or P-series filter.

    Note: N-series filters cannot be used if oil particles are present.
  - If oil particles are present and the filter is to be used for more than one work shift, use only a P-series filter.

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Types of Respirators

- NIOSH Video

"A Particle is a Particle"

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Chemical Work Site Safety Hazards

- Asbestos Containing Materials (ACM)
- Lead (LBP)
- Chemicals
  - Cleaners
  - Disinfectants
  - Sealers

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Asbestos: What Is It?

- Asbestos minerals share some common characteristics:
  - Naturally occurring from Ores rich in Magnesium, Calcium, Silica, and Iron
  - High tensile strength along the axis of the fiber
  - Chemically inert
  - Non-combustible

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Mold on Asbestos Containing Materials

ACM- Pipe insulation (T.S.I)

ACM- Spackle/Joint compound

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Definition

ACM= **A**sbestos **C**ontaining **M**aterials

- This is any material that contains **greater** than 1% asbestos fibers

PACM=**P**resumed **A**sbestos **C**ontaining **M**aterials

- This is any TSI, Surfacing, or Misc vinyl/asphalt flooring or roofing installed before 1980

  It should be noted that New York State Department of Labor (NYSDOL), United States Environmental Protection Agency (EPA), and the Occupational Safety and Health Administration (OSHA) all have specific requirements for the testing, handling and disposal of ACM, also for licensing and training. One should always check with all applicable regulations before disturbing any Known or suspect ACM/PACM present on a mold remediation/Assessment

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Lead Based Paint

On mold remediation projects Lead based paint can also be impacted.

- It will typically be in the paint on or near the areas with mold growth
- Demolition or removal of these painted surfaces can create potentially dangerous exposures to Lead dust and lead contaminated debris

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Why are Dust and Debris a Problem?

- Remediation activities that disturb lead-containing materials create dust and debris
- Lead-contaminated dust is poisonous
- Very small amounts of lead-contaminated dust can poison children and adults
  - **Children swallow dust during ordinary play activities.**
  - **Adults swallow or breathe dust during work activities.**
- Workers can bring lead-contaminated dust home and poison their families

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Lead Renovations

- EPA requires that those conducting renovation, repair & painting obtain RRP certification and use Lead Safe Work Practices (LSWP)
- HUD requires LSWP for activities that disturb more than 2 sq ft of painted surface in any one room

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Electrical Hazards

- Volts (Voltage)
- Amps (Current)
- Ohms (Resistance)
- Watts (Power)

Which of the above can kill a person when they come into contact with electricity?

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Electrical Hazards

The answer is Amps.

It only takes approximately 0.1 to 0.2 amps (or 100 to 200 milliamps) to be lethal to a person!

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Electrical Hazards

- Electrocution and electric shocks are common hazards.
- Incorrect wiring, improper grounding, and lack of proper insulation result in over 1,000 people being electrocuted each year

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Steps for Reducing Electrical Hazards

- Inspect for wiring faults in cords and electric tools
- Remove all electrically powered equipment
- Protect cables lines and outlets
- If electrical circuits, machinery, and other electrical systems in or passing through the regulated abatement work area must stay in operation, the procedures for plasticizing and labeling must be followed, as outlined in NYCRR 56-7.7

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Hazard – Damaged Cords

- Cords can be damaged by:
  - Aging
  - Door or window edges
  - Staples or fastenings
  - Abrasion from adjacent materials
  - Activity in the area
  - Improper use can cause shocks, burns or fire

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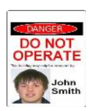
Lockout and Tagging of Circuits

- "Authorized " person will de-energize all sources
- Locking device will be applied at energy source
- Lock must be unique in appearance and used for no other purpose
- Tag deactivated controls
- Tag de-energized equipment and circuits at all points where they can be energized
- Tags must identify equipment or circuits being worked on
- A separate tag and lockout is provided for each crewmember/contractor requiring de-energizing of same line or equipment



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Lockout and Tagging of Circuits

- When to Lock Out/Tag Out?
- Any time injury could result from unexpected start-up of machinery
- Any time injury could result from release of energy
  - Electrical energy
  - Chemical energy
  - Hydraulic pressure
  - Air pressure
  - Steam pressure

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Use of Ground-fault Circuit Interrupter (GFCI)

- Protects you from shock
- Detects difference in current between the black and white wires
- If ground fault detected, GFCI shuts off electricity in 1/40th of a second
- Use GFCI's on all 120-volt, single-phase, 15- and 20-ampere receptacles, or have an assured equipment grounding conductor program.
- A GFCI must be located at the Source of the power

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Temporary Lights

- Protect from contact and damage, and don't allow to lay on the ground

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Hazard
Improper Grounding

- Tools plugged into improperly grounded circuits may become energized
- Broken wire or plug on extension cord
- Some of the most frequently violated OSHA standards


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Hazard
Overloaded Circuits

Hazards may result from:

- Too many devices plugged into a circuit, causing heated wires and possibly a fire
- Damaged tools overheating
- Lack of overcurrent protection
- Wire insulation melting, which may cause arcing and a fire in the area where the overload exists, even inside a wall

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Summary –
Cords & Wires

- Insulate live wires
- Check before use
- Use only cords that are 3-wire type
- Use only cords marked for hard or extra-hard usage
- Use only cords, connection devices, and fittings equipped with strain relief
- Remove cords by pulling on the plugs, not the cords
- Cords not marked for hard or extra-hard use, or which have been modified, must be taken out of service immediately

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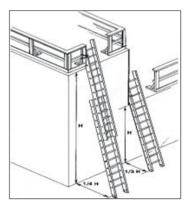
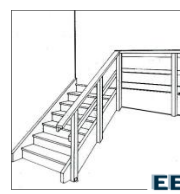
Stairways and Ladders

34

Ladders - General Requirements

- Ladders must be kept in a safe condition
- Keep the area around the top and bottom of a ladder clear
- Feet on solid, level surface
- Ladder fully opened and side rails locked
- Keep ladders free from slipping hazards
- Never stand or sit on top, or work from top step of ladder

35

Proper Ladder Use

- Use ladders for their intended purpose
- 4:1 lean ratio for extension ladders
- Step ladders should be fully open and locked in place before using them

36

Proper Ladder Use

- Tools or other objects should not be stored on the top or any step of a ladder
- Inspect ladders always before using them
- Portable ladders are not intended for group use (one person to a ladder)

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Climbing the Ladder

- Face the ladder when going up or down
- Always maintain three points of contact when climbing or descending a ladder
- Do not carry any object or load that could cause you to lose balance

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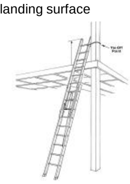
Ladder Rail Extension

- When using a portable ladder for access to an upper landing surface, the side rails must extend at least 3 feet above the upper landing surface



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What Is A Scaffold?

An elevated, temporary work platform

Three basic types:

- **Supported scaffolds** -- platforms supported by rigid, load bearing members, such as poles, legs, frames, & outriggers
- **Suspended scaffolds** -- platforms suspended by ropes or other non-rigid, overhead support
- **Aerial Lifts** -- such as "cherry pickers", "boom trucks" or "scissor lifts"

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Scaffolds

Specific OSHA standards apply to the use of scaffolding, which must be reviewed prior to construction or use

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Scaffold Height

The height of the scaffold should not be more than four times its minimum base dimension unless ties or braces are used

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Mobile Scaffolds

- Employees can't be on a moving scaffold unless:
  - Surface is level
  - Height to base ratio is 4 to 1
  - Outriggers are installed on both sides of scaffolds
- Employees can't be on scaffold while it is being moved- tipping hazard

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Scaffolds

- Guard rails should always be installed per OSHA whenever scaffolding is from 4 to 10 feet tall and less than 45" wide and must be used when scaffolding is taller than 10 feet.
- Planking used on scaffolding must extend at least 6" but no more than 12" past the edges, and always secured to the frame

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Scaffolds

- Kick plates must be used regardless of scaffolding height to keep tools from being knocked off and hitting someone
- When scaffolds or ladders are in use, approved hard hats must be worn to prevent injury from falling objects

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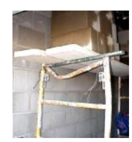
Scaffold Inspection

- Competent person inspects scaffolds for visible defects before each shift and after any alterations
- Defective parts must be immediately repaired



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Problems With Heat

- The body naturally tries to cool itself by sweating
- If you are wearing an impermeable suit, your body heat cannot escape
- Your lungs are already in overdrive due to the added stress of the respirator
- The Air Conditioning has been shut off for the summer, and the air in the work area is much warmer than the air outside
- Perfect conditions for the onset of HEAT STRESS or HEAT STROKE

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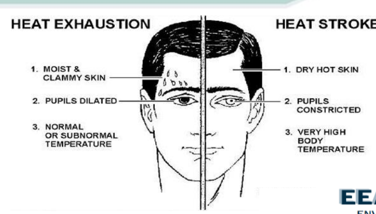
Heat-Related Illnesses



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Heat Stress

- Happens when you over sweat
- Symptoms include: cool, sweaty skin; headache; dizziness; nausea and disorientation

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Heat Stress First Aid

- Move to shade or cool place
- Give fluids (if no nausea)
- Cool victim (no ice, cold compresses)
- Depending on severity, seek medical attention

50

Heat Stoke

- If heat stress continues it may progress to HEAT STROKE
- This is a life-threatening condition

51

Heat Stroke

Symptoms include: Hot, dry skin; delirium; severe headache and loss of consciousness

- HEAT STROKE IS A TRUE MEDICAL EMERGENCY THAT REQUIRES IMMEDIATE MEDICAL ATTENTION

52

Preventing Heat-Related Illnesses

- Take frequent breaks, reduce body temperature
- Drink small amounts of water (air temperature) often
- Monitor heart rate after breaks – should return to within 10% of normal
- Body core temp should remain below 102 degrees

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Confined Spaces

- Definition of a confined space is any space that
  - A person can enter
  - Has a limited openings for entry or exit
  - Is not designed for continuous occupancy
- A confined space that has any associated hazard is considered a permit-required confined space
- Hazards can include oxygen deficient or enriched atmospheres, toxic or flammable atmospheres, mechanical or electrical hazards, falls, engulfment, etc.

54

Confined Spaces

Do not enter a confined space to attempt to rescue unless you are properly trained and outfitted with the correct protective equipment (including your own safety retrieval harness, with someone tending your line).

55

Confined Spaces

60% of confined space deaths are among would-be rescuers. Don't become a statistic!

56

Hazard Communication or Right-to-Know

If chemical hazards are introduced to the workplace, the employer must have a written hazard communication program to inform employees of these hazards.

Hazardous materials may be present on asbestos abatement sites for a number of reasons.

Examples of potentially hazardous materials include spray adhesives, surfactants, encapsulates, paints and coatings, mastic removers, solvents and cleaning agents.

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Hazard Communication Plan Elements

A written Hazard Communication Program which must include:

- Plans to meet the criteria of the standard relating to the labeling, material safety data sheets, and employee training.
- A list of hazardous chemicals/materials.

58

Hazard Communication Plan Elements

- The methods to be used to inform employees and outside contractors of hazards of non-routine tasks.
- The hazards associated with chemicals contained in unlabeled pipes or vessels in the work area, as well as hazardous materials released while using a product.
- The methods to be used to inform outside contractors who may work on the premises of the hazards to their employees.

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Hazard Communication Plan Elements

- Safety Data Sheets.
- All chemicals used in the work place must have material safety data sheets available at the work site, which must include all health hazard exposures, as well as physical hazards and emergency procedures.
- All material safety data sheets must be accessible to all employees during any working time, which includes all three shifts, where applicable.

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Safety Data Sheet (SDS)

- **Section 1, Identification** includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
- **Section 2, Hazard(s) identification** includes all hazards regarding the chemical; required label elements.
- **Section 3, Composition/information on ingredients** includes information on chemical ingredients; trade secret claims.
- **Section 4, First-aid measures** includes important symptoms/effects, acute, delayed; required treatment.

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Safety Data Sheet (SDS)

- **Section 5, Fire-fighting measures** lists suitable extinguishing techniques, equipment; chemical hazards from fire.
- **Section 6, Accidental release measures** lists emergency procedures; protective equipment; proper methods of containment and cleanup.
- **Section 7, Handling and storage** lists precautions for safe handling and storage, including incompatibilities.
- **Section 8, Exposure controls/personal protection** lists OSHA's Permissible Exposure Limits (PELs); ACGIH Threshold Limit Values (TLVs); and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the SDS where available as well as appropriate engineering controls; personal protective equipment (PPE).

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Safety Data Sheet (SDS)

- **Section 9, Physical and chemical properties** lists the chemical's characteristics.
- **Section 10, Stability and reactivity** lists chemical stability and possibility of hazardous reactions.
- **Section 11, Toxicological information** includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.
- Section 12, Ecological information*
  Section 13, Disposal considerations*
  Section 14, Transport information*
  Section 15, Regulatory information*
- **Section 16, Other information,** includes the date of preparation or last revision.

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Hazard Communication Plan Elements

Labels.

- All containers in the work place must be labeled, marked, or tagged with the identity of the hazardous material contained; the appropriate hazard warnings, including pictograms; and the name and address of a responsible party.
- An exception from labeling is given for containers used by a single individual which hold only sufficient product for use during one shift.

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Hazard Communication Plan Elements

- Training for employees exposed to any hazardous chemicals in their work place must include:
- The requirements of the Federal Hazard Communication Standard and the New York State Right-to-Know Law.
- Information regarding the operations involving hazardous chemicals.
- The location and accessibility of the Material Safety Data Sheets.

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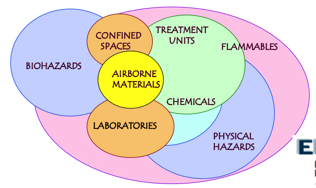
Hazard Recognition

Look at the BIG picture!



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Hurt at Work

- You've carefully thought out all the angles.
- You've done it a thousand times.
- It comes naturally to you.
- You know what you're doing, its what you've been trained to do your whole life.
- Nothing could possibly go wrong, right ?

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Think Again!

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Hazard Recognition

Most injuries shouldn't have happened!

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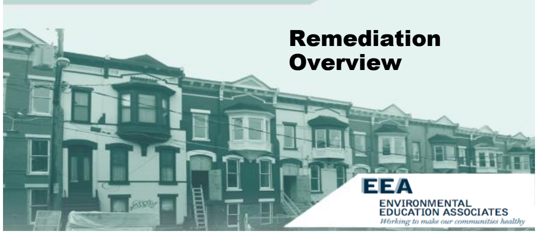
NYSDOL MOLD TRAINING



Remediation Overview

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1

Remediation Overview

Remediation Planning

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2

Remediation Basics

- Get rid of the water!
- Get rid of the food!
- Kill, then control!
- Don't forget the air!
- Vac! Wash! Vac!

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Remediation Basics

- Restrict access to work area and post signs
- Construct containment & install engineering controls
- Remove contaminated and water damaged porous building materials
- Clean & decontaminate non-porous materials
- Clean & seal exposed surfaces
- Evaluate for completeness of work

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Remediation Basics

- You can clean without disinfecting
- You can NOT disinfect without cleaning

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5

Three (or four) C's of Remediation

- Contain
  - ✓plastic sheeting, duct tape
  - ✓allow for decontamination, staging areas
- ✓Control
  - ✓vacate adjacent areas as appropriate
  - ✓engineering controls & work practices
- Clean
  - ✓Cleaners, sanitizers, disinfectants & sealers
- Clearance
  - ✓Independent mold assessor

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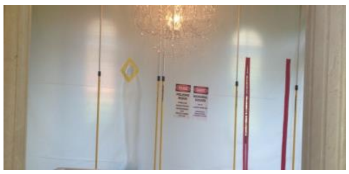
6

Containment



7

Engineering Controls

- Negative Air
- HEPA Equipped
  - Vacuum
  - Exhaust Filtration
  - Power tools w/dust collection shroud & HEPA vac

8

Engineering Controls

9

Fungicides & Fungistats

- Sodium Tetraborate
- Sodium Hypochlorite (Bleach)
- Quaternary Ammonium Compounds
- Other Disinfectants

10

Sodium Hypochlorite (Bleach)

- **Advantages**
  - Cheap
  - Effective
  - Removes discoloration from white surfaces
- **Disadvantages**
  - Not compatible with all surfaces
  - Safety issues
  - Not a cleaner
  - Inactivated by heavy organic soil
  - Unstable

11

Follow Manufacturer's Directions

- Use the right dilution
- Use the right application
- Change solution when recommended
- Avoid cross-contamination

12

Remediation Overview

Video – "Mold Remediation Process"

-Swartz Restoration & Emergency Services

13

Points to Remember

- Eliminating water is the best way to eliminate fungi
- You cannot disinfect and kill fungi without cleaning first
- Choose the right chemicals &/or equipment for the job and follow manufacturer's directions
- Healthy employees are the best

14

NYS Mold Training Work Area Preparation

1

Overview of Containment

- The goal of containment is to limit the spread of mold throughout the building in order to minimize the exposure of remediators and building occupants to mold.
- The larger the contaminated area, and the greater the possibility that someone will be exposed to mold, the greater the need for containment.

2

Overview of Containment

The size of the contaminated area indicates the level of containment required, the final choice of containment level should be based on professional judgment.

Heavy mold growth in a small area could release more mold spores than lighter growth in a relatively large area. In this case, the smaller contaminated area may warrant a higher level of containment.

3

EPA Guidelines for Containment

Two types of containment are described in EPA's mold remediation guidance:

- ***Limited***- Limited containment is generally used for areas involving between 10 and 100 square feet of mold contamination.
- ***Full containment-*** is used when areas larger than 100 square feet are to be remediated or in cases where it is likely that mold could be spread throughout the building during remediation

4

Limited Containment

- A single layer of 6-mil fire-retardant polyethylene sheeting enclosing the moldy area.
- Access to the contained area is through a slit entry covered by a flap on the outside of the containment area.
- containment is generally recommended for areas involving 10 to 100 square feet of mold contamination.

5

Limited Containment

- In small areas, the polyethylene sheeting can be secured to the floor and ceiling with duct tape. In larger areas, a frame of steel or wooden studs can be built to hold the polyethylene sheeting. Epoxy can also be used to fasten the sheeting to the floor or ceiling.

6

Limited Containment

- All supply and air vents, doors, and pipe chases in the containment area must be sealed with polyethylene sheeting to minimize the spread of mold and mold spores to other areas of the building. Stairs should also be sealed if a riser is missing or open.

7

Full Containment

- Full containment is recommended for the clean up of mold-contaminated surface areas of more than 100 square feet and when intense or long-term exposures are expected.
- It is also recommended if it appears likely that the occupant's space would be further contaminated if full containment were not used because high levels of airborne dust or mold spores are likely.

8

Full Containment

- Full containment requires double layers of polyethylene sheeting to create a barrier between the moldy area and other parts of the building. A decontamination chamber or airlock -- an area with doors between the contaminated area and the clean area should be built for entry into and exit out of the remediation area

9

Full Containment

- The entryways from the outside into the airlock and from the airlock into the containment area should be slits covered by flaps on the outside surface. The chamber should be large enough to hold a waste container and allow a worker to put on and remove Personal Protective Equipment (PPE). All contaminated PPE, except respirators, should be placed in a sealed bag while in this chamber.

10

Preparing the Work Area

- Post Warning Signs
- Pre-cleaning
- Remove objects
- Installation of critical barriers & Isolation Barriers
- Establishing Negative Pressure Systems
- Plasticizing Surfaces

11

Preparing the Work Area

- Pre-clean and remove all movable objects using a HEPA-filtered vacuum and or wet cleaning
  - Carpet and upholstery to remain must be HEPA-vacuumed twice
  - Carpeting to be left in place must be covered with 3/8 inch plywood
- Pre-clean and isolate all non-movable objects with 2 layers of poly

12

Non-Movable Items

- Items which can't be moved must be cleaned, covered and sealed with two layers of 6 ml poly to protect them from damage and contamination

13

Work Area Prep

- Regulated abatement area must be cleaned (HEPA vac and/or wet methods)
  - Methods that raise dust are prohibited
- Pre-cleaning intended for preparation work only!
  - No disturbance of visible mold until containment is established

14

Work Area Prep

- Order of Pre-clean activities
  - Clean areas (HEPA-vac and wet methods) where critical barriers and isolation barriers are to be installed
  - After installation of isolation and critical barriers, negative air ventilation units are to be started

15

Work Area Prep

- Pre-clean and install critical barriers
- Barriers are constructed to seal off all openings and penetrations to the work area
- Barriers to be constructed of 6 ml fire-retardant poly sealed with duct tape

16

Isolation Barriers

Install poly over:

- Windows
- Doorways
- Corridors
- Skylights
- Ducts
- Grilles or Diffusers
- ANY PENETRATION of the work area where spores can migrate

17

Work Area Prep

- After the negative pressure/ air scrubber system is functioning, all surfaces are to be pre-cleaned and plasticized
- All floor, wall, and ceiling surfaces will be covered with 2 layers of 6 mil fire-retardant poly.

18

Installation of Wall Poly

19

Work Area Prep

The time that a contractor invests in prepping the work area is easily regained during the clean-up phase.

20

NYSDOL Mold Training

State of the Art Work Practices and New Technologies

1

Three (or four) C's of Remediation

- Contain
  - ✓plastic sheeting, duct tape
  - ✓allow for decontamination, staging areas
- ✓ Control
  - ✓vacate adjacent areas as appropriate
  - ✓engineering controls & work practices
- Clean
  - ✓Cleaners, sanitizers, disinfectants & sealers
- Clearance
  - ✓Independent mold assessor

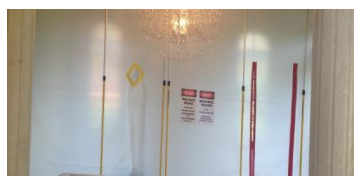
2

Containment

- Containment
  - plastic sheeting, duct tape
  - exhaust fan with HEPA filter
  - allow for decontamination, staging areas
- Control of Exposure
  - vacate adjacent areas as appropriate

3

Containment



4

Engineering Controls

- Negative Air
- HEPA Equipped
  - Vacuum
  - Exhaust Filtration
  - Power tools w/dust collection & HEPA Vacuum

5

Engineering Controls

6

Engineering Controls

- Ozone treatments
  - Isolate & destroy particulate
- Dehumidifiers
- Desiccants
  - Dry up moisture

7

New Technologies & Treatments

- Chemical treatments
- Foggers
- Dry Ice
- Radiant Heat

8

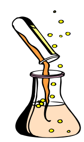
Fungi Control

- You can clean without disinfecting
- You can NOT disinfect without cleaning

9

Fungicides/Fungistats

- Sodium Tetraborate
- Sodium Hypochlorite (Bleach)
- Quaternary Ammonium Compounds
- Other Disinfectants



10

Sodium Hypochlorite (Bleach)

- Advantages
  - Cheap
  - Effective
  - Removes discoloration from white surfaces
- Disadvantages
  - Not compatible with all surfaces
  - Safety issues
  - Not a cleaner
  - Inactivated by heavy organic soil
  - Unstable

11

Follow Manufacturer's Directions

- Use the right dilution
- Use the right application including dwell times
- Change solution when recommended
- Avoid cross-contamination

12

Foggers

Mold foggers produce a mist of antimicrobial and odor-controlling solution designed for mold remediation. This mist evenly coats everything in the area and either kills or encapsulates mold on all types of surfaces.

13

Dry Ice Blasting

14

Dry Ice Blasting

- Blasting gun fires dry ice particles (rice-sized) at supersonic speed to impact and clean a surface. The particles are accelerated by compressed air, just as with other blasting systems.
- Upon impact the dry ice sublimates (goes from a solid to a gas without passing through a liquid phase). The substrate (surface) is left free of mold spores with very little damage.

15

Radiant Heat

- Radiant heaters for mold remediation, bed bug treatment and similar projects. This new technology for mold remediation is more efficient than previous heating options.

16

Radiant Heat

- Using heat to combat contaminants is a new idea but it is based on traditional scientific findings dating back to the 19th century, when Louis Pasteur proved that heat is an effective way to eliminate bacteria and other contaminants.
- This process, known as pasteurization, is a common technique in the food industry. The same principle, applied using specialized heat in buildings meets mold remediation standards, eliminates dust mites and bed bugs, and more.
- A single treatment is able to eliminate several potential hazards without introducing potentially harmful chemicals into the structure or surrounding environment.

17

Remediation Hygiene Practices

- Proper PPE
  - negative pressure respirators
  - coveralls
  - gloves
- Hygiene
  - hand hygiene
  - decontamination
  - respirator disinfection

18

Points to Remember

- Eliminating water is the best way to eliminate fungi
- You cannot disinfect and kill fungi without cleaning first
- Choose the right EPA-recognized chemicals &/or equipment for the job and follow manufacturer's directions

19

NYSDOL MOLD TRAINING

Regulatory Requirements & Guidelines

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1

Public Awareness

DAILY NEWS

NYC Housing Authority to come under judicial oversight over mold in apartments

A child in a NYCHA apartment with mold on the wall. The New York City Housing Authority will come under federal judicial oversight over mold in apartments, enabling residents to go directly to a federal judge if the agency does not resolve the problem. (Richard Harbus for New York Daily News)

- Receiving Attention
  - Media
  - Medical
  - Legal
- Baez Lawsuit

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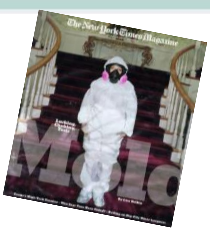
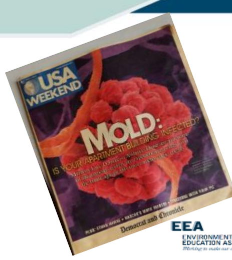
Public Awareness





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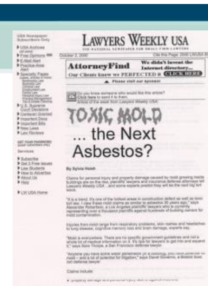
3



LAWYERS WEEKLY USA

AttorneyFind

TOXIC MOLD
... the Next Asbestos?

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Baez Lawsuit

Maribel Baez vs NYCHA ("Baez") is a class action lawsuit filed December 2013, as a violation the Americans with Disabilities Act for the conditions of mold and excessive moisture for residents suffering from asthma.

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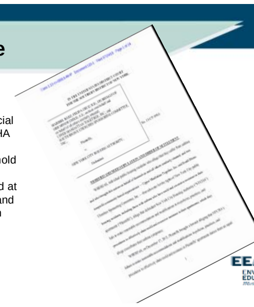
Consent Decree

- In partnership with the Special Master and Plaintiffs, NYCHA has revised its standard procedure for addressing mold complaints.
- These changes were piloted at 38 developments in 2017, and will be launching citywide in January 2019



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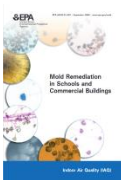
Agency Guidelines



- New York City Department of Health and Mental Hygiene "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" – 2008
- EPA Mold Remediation in Schools and Commercial Buildings – 2008
- OSHA "Brief Guide to Mold in the Workplace" – 2013

7

Agency Guidelines

New York City Department of Health and Mental Hygiene "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" – 2008

- Environmental Assessment
  - Visual Inspection
  - Environmental Sampling
- Communication with Building Occupants

8

Agency Guidelines

New York City Department of Health and Mental Hygiene "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" – 2008

- Remediation
  - Moisture Control and Building Repair
  - Worker Training
  - Cleaning Methods
  - Quality Assurance Indicators
  - Restoring Treated Spaces

9

Agency Guidelines

New York City Department of Health and Mental Hygiene "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" – 2008

- Remediation Protocol
  - Small Isolated Areas (less than 10 square feet) – e.g. ceiling tiles, small areas on walls
  - Medium-Sized Isolated Areas (10 – 100 square feet)
  - Large Areas (greater than 100 square feet in a contiguous area) – e.g. on separate walls in a single room

10

Agency Guidelines

New York City Department of Health and Mental Hygiene "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" – 2008

- Remediation of HVAC Systems
  - Small Isolated Area of Mold Growth in the HVAC System (<10 square feet) – e.g. box filter, small area on insulation
  - Large Area of Mold Growth in the HVAC System (>10 square feet)

11

Agency Guidelines

EPA Mold Remediation in Schools and Commercial Buildings – 2008

- Mold Remediation – Key Steps
- Plan the Remediation Before Starting Work
- Remediation Planning
- HVAC System

12

Agency Guidelines

EPA Mold Remediation in Schools and Commercial Buildings – 2008

- **Remediation**
  - Table 1: Water Damage – Cleanup and Mold Prevention
  - Table 2: Mold Remediation Guidelines
  - Cleanup Methods
  - Personal Protective Equipment (PPE)
  - Containment
  - Equipment

13

Agency Guidelines

OSHA "Brief Guide to Mold in the Workplace" – 2013

- Skin and Eye Protection -
- Respiratory Protection
- Protective Clothing
- Remediation methods – per EPA/NYC
- Sampling – Not Recommended for visible mold
- Equipment for Assessment & Remediation

14

Trade Organization Protocols

Institute of Inspection, Cleaning and Restoration Certification (IICRC) S520

- a procedural standard and reference guide for the remediation of mold damaged structures and contents and is based on reliable remediation and restoration principles, research and practical experience, and attempts to combine essential academic principles with practical elements of water damage restoration for technicians facing "real-life" mold remediation challenges.

15

NYS Regulations - Article 32

- Signed by Governor January, 2015
- Establishes certification and licensing program with fees
- Provides for accreditation of training providers
- Establishes standards for assessment & remediation
- Defines practices & procedures

16

NYS Article 32

- Enforced by NYS Dept of Labor Division of Safety & Health
- Assigns Roles & Responsibilities
  - Mold Assessors
  - Mold Remediation Contractors
  - Mold Abatement Supervisors
  - Mold Abatement Workers

17

NYS Article 32

Establishes Standards for:

- Mold Remediation Plans by Assessors
- Mold Remediation Work Plans by Contractors
- Post–remediation Assessment by Assessors

18

NYS Article 32

The Mold Remediation Plan Must Specify:

- The rooms or areas where the work will be performed
- The estimated quantities of materials to be cleaned or removed
- The methods to be used for each type of remediation in each type of area
- The PPE to be supplied by licensed remediators for use by licensed abaters
- The proposed clearance procedures and criteria for each type of remediation in each type of area
- Occupant notification
- Recommendations for notice and posting requirements
- An estimate of cost and an estimated time frame for completion
- When possible, the underlying sources of moisture that may be causing the mold and a recommendation as to the type of contractor who would remedy the source of such moisture.

19

NYSDOL Mold Remediation Work Plan

- A licensed Mold Remediation Contractor will utilize the information provided by the Mold Assessment Consultant in the *Mold Remediation Plan* and generate a *Mold Remediation Work Plan* specific to each project.
- The Work Plan must fulfill all the requirements of the mold remediation plan developed by the Mold Assessment Consultant as provided to the client and provide specific instructions and/or standard operating procedures for how a mold remediation project will be performed.

20

NYS Article 32

Post-remediation Assessment And Clearance

- Determine whether the work area is free from all visible mold
- All work has been completed in compliance with the remediation plan and remediation work plan meets clearance criteria specified in the plan.

21

NYS Article 32

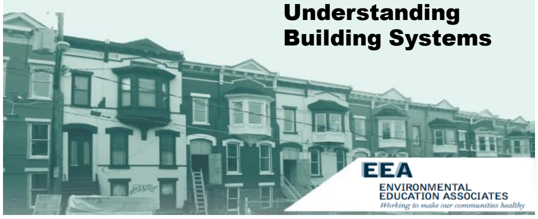
EXEMPTIONS

- A residential property owner who performs mold inspection, assessment, remediation, or abatement on his or her own property;
- A non-residential property owner, or the employee of such owner, who performs mold assessment, remediation, or abatement on an apartment building owned by that person where the property has four or less dwelling units;
- An owner or a managing agent or a full-time employee of an owner or managing agent who performs mold assessment, remediation, or abatement on commercial property or a residential apartment building of more than four dwelling units owned by the owner. This exemption will not apply if the managing agent or employee engages in the business of performing mold assessment, remediation, or abatement for the public; and
- A federal, state or local governmental unit or public authority and employees thereof that perform mold assessment, remediation, or abatement on any property owned, managed or remediated by such governmental unit or authority.

22

NYSDOL MOLD TRAINING

Understanding Building Systems



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1

Building Construction

Residential Properties are built according to:
- Design Objectives
- Building Code
- Housing Code
- Permitting Requirements

2

Construction Documents

- Specifications
- Drawings
- Addenda
- Change Orders
- Submittals
- Shop drawings
- As built drawings

3

Understanding Building Systems

- Physical Layout
- Architectural Plans
- Structural Plans
- Electrical Plans
- Plumbing Plans
- HVAC Plans
- Fire Suppression

} Mechanical Plans

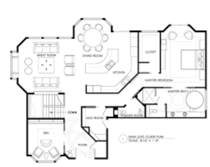
4

Understanding Building Systems: Building Plans

- Floor plans are basis for mechanical, plumbing & electrical drawings
- Include elevations (vertical)
- Details (Isolated areas of construction)
- Sections (Cut vertically)
- Notes (General or specific)
- Schedules (Info regarding building)

5

Architectural Plans



6

Understanding Building Systems: Structural Plans

The Structural system is the “skeleton” of the building.

- Details of floors, framework and foundations
- Structural beams, columns and slabs
- Wood framing
- Drywall/gypsum or Plaster
- Concrete versus steel beams

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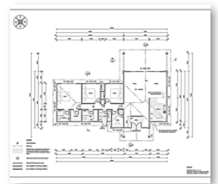
Structural Plans



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Understanding Building Systems: HVAC Plans

- Based on building floor plans
- HVAC schematic or system design/diagram to indicate the HVAC system operation.
- Ductwork routing and piping systems.
- Details, notes, schedules, sections and elevations.
- Boilers, radiators and air handling units.

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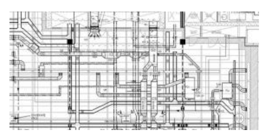
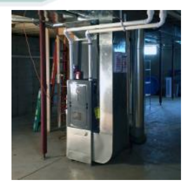
HVAC Plans





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Understanding Building Systems: Plumbing Plans

- Location of tanks, pipes & drains for supply & return fluids, waste & pressure equalizer pipes
- Locates remediation/clean-up water supply sources
- Quantities of materials in inaccessible areas
- Used to estimate quantities of potential mold contamination on building materials or surfaces

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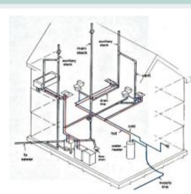
Plumbing Drawings



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Understanding Building Systems: Fire Suppression Plans

- Based on building floor plans
- Location of sprinkler supply lines and sprinkler heads
- Location of other fire suppression systems such as dry chemical systems
- Location of sensory equipment and alarm systems

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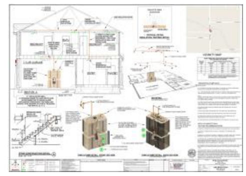
13

Fire Suppression Drawings

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Understanding Building Systems: Electrical Plans

- Based on floor, power & lighting plans
- Includes Notes, schedules & details
- Calculations for load requirements
- Location of panels, switches, receptacles, etc.
- ID's paper insulation, cable wrap & cementitious panels
- ID's temporary electric service needs

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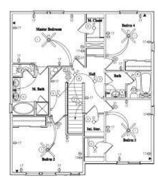
Electrical Plans

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NYSDOL MOLD TRAINING

HVAC Systems & Ventilation

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1

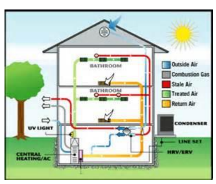
HVAC

Heating, Ventilation & Air Conditioning

2

HVAC Systems Primary Functions

- Temperature Control
  - Cooling
  - Heating
- Humidity Control
  - Humidification
  - Dehumidification
- Air Quality Control
  - Ventilation
  - Cleaning



3

Ventilation - Guiding Questions

- Why is ventilation important?
- How is it achieved in buildings (and others)?
- What are the most common problems?
- What are some best practices for resolving these problems?

Ventilation Basics 1
Ventilation Basics 2

4

Purpose of Exhaust Ventilation

To remove pollutants at their source:
- Kitchens; Cooking grease, water vapor, gas, CO
- Bathrooms; Moisture = Mold

- To provide adequate fresh air to a space
- Required by Building Code

5

Ventilation

- **Natural Ventilation**
  - Operable window
- **Central Exhaust Rooftop Fans**
  - Vertical shafts
  - Horizontal takeoffs
  - Wall or ceiling grilles
- **In-line fans**
  - Small fan in the duct
  - Most energy efficient
- **Continuous vs. Intermittent**

6

Evaluating The Ventilation System

- Does the building have a ventilation system?
- Is the system on all the time?
- Is the system continuous or does it go on and off during the day?
- Does each room have a vent?
- Are the vents supplying or removing air?

7

Examples of Exhaust Ventilation

8

Ventilation Systems

Grill & duct build up is common and fungal growth can attach to that debris. While we do not remove registers and air vents we must ensure that we visually verify that debris and dust has not accumulated in the ducting and providing a growth platform for mold.

9

Functioning Roof Fan

10

Air Conditioning

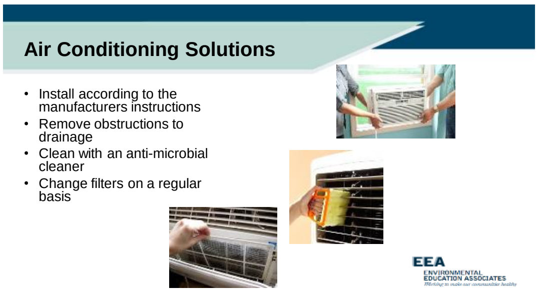
- Some residential units do not have central air conditioning
- Window units account for efforts to cool spaces

11

Air Conditioning Problems

- Leaking or poorly installed AC units can result in water damage and mold contamination in the unit and on adjacent building materials

12


Air Conditioning Solutions
• Install according to the manufacturers instructions
• Remove obstructions to drainage
• Clean with an anti-microbial cleaner
• Change filters on a regular basis
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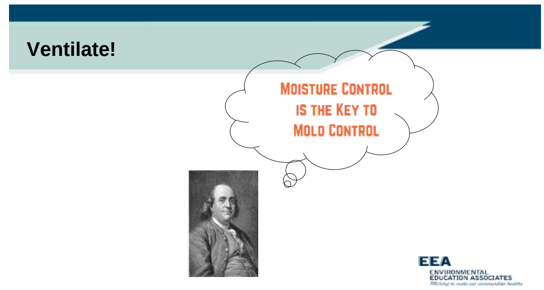
Ventilate!
MOISTURE CONTROL IS THE KEY TO MOLD CONTROL
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14

NYSDOL Mold Training

Requirements for worker protection, Respiratory program, Safety plans & Medical Surveillance

1

Respirator Guidelines

- Not required, but strongly recommended
- If used, must follow OSHA and other Federal, State & local requirements
  - EPA
  - NYS
  - NYC

2

Respirator Recommendations

- EPA: "**Mold Remediation in Schools and Commercial Buildings"**
- "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 is recommended."

3

Respirator Recommendations

NYS Dept. of Labor

Article 32 **"Licensing of Mold Inspection, Assessment and Remediation Specialists and Minimum Work Standards"**

4

Respirator Recommendations

Article 32 Section 945 specifies:

- "A mold assessment licensee shall prepare a mold remediation plan that is specific to each remediation project…"
- The plan must specify among other things, the level of personal protective equipment to be supplied to and used by remediation personnel.

5

Respirator Recommendations

NYC Dept. Of Mental Health and Hygiene

"Guidelines on Assessment and Remediation of Fungi in Indoor Environments"

6

Respirator Recommendations

NYC Guidelines state that:

- "Using personal protective equipment such as gloves and respiratory protection (e.g. N-95 disposable respirator) should be considered if assessment work might disturb mold."

7

Respirator Recommendations

NYC Guidelines further recommends the following respiratory protection during remediation:

Small Isolated Areas (<10 sf)	N-95 Respirator
Medium Isolated Areas (10 – 100 sf)	N-95 Respirator
Large Areas (>100 sf)	Half-face Respirator w/ P-100 filters.

All respirator use should be in accordance with OSHA 29 CFR 1910.134

8

Respirator Recommendations

Institute of Inspection, Cleaning and Restoration Certification (IICRC S-520)

Section 8.3.2

Employers shall provide PPE for employees entering a containment area to remediate microbial contamination. S-520 also references OSHA 29 CFR 1910.132 and 134

9

OSHA General Duty Clause

Where there are no specific regulations:

"Each employer shall furnish employees a place of work that is free from recognized hazards that are likely to cause harm."

10

General Duty Clause

If Hazards are found, the Employer Must……

- Eliminate the Hazard
- Employ Engineering Controls
- Employ Administrative Control
  - Note: The use of employee *rotation* in order to keep an employee's exposure under the OSHA PEL for asbestos is *prohibited*
- Issue Personal Protective Equipment

11

Personal Protective Equipment

- Use of personal protective equipment (PPE) is the last resort used to protect the worker only after elimination and/or the use of engineering controls have been exhausted
- The *employer* is responsible for the *selection* of PPE

12

Personal Protective Equipment

- OSHA 29 CFR 1910.132
- "Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices…shall be provided, used and maintained whenever it is necessary by reason of hazards of processes or environment… capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact."

13

Personal Protective Equipment

- **Respirator**
- **Disposable Suit**
- **Gloves**
- **Hearing Protection**
- **Boots**
- **Safety Toe Shoes/Boots**
- **Hard Hat**
- **Eye Goggles**

Note: Leave contaminated safety equipment on the job site; do not bring contamination home Leave work clothes at work.

14

Respirator Definition:

"A personal device designed to protect the wearer from the inhalation of hazardous atmospheres." (ANSI Z88.2, 1992)

15

Employer Responsibilities

- employees must have proper protection
- employees must be medically fit
- employees must be trained
- required fit testing
- written respiratory protection program

16

Selection of Respirators

- use only approved respirators
- what you need to know when selecting respirators
- other important factors

17

Respiratory Protection Program

Employers who's employees wear respirators must have a written Respiratory Protection Program

18

Respiratory Protection Program (OSHA 29 CFR 1910.134)

- Written program with roles and responsibilities
- Hazard assessment
- Respirator selection (NIOSH approved)
- Medical evaluations
- Training on respiratory hazards and proper use
- Fit testing
- Written procedures for use
- Procedures for cleaning/ storing/inspecting and repairing
- ASR flow, quality verification
- Program evaluation

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Respirator Selection

- The respirator must be:
  - provided by the employer at no cost to employee
  - appropriate to the job
  - selected among those having a NIOSH approved number on the label
- The employer must provide a positive pressure (PAPR) respirator instead of a negative pressure respirator if the employee requests it

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Requirements to Wear a Respirator

- Individuals must be medically cleared to wear any respirator prior to use
- Medical status must be reviewed annually
- Must have lung function (pulmonary function) testing
- Persons must be qualitatively or quantitatively fit tested at least once per year
- Persons must be trained in the use and inspection of respiratory equipment

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Respiratory Hazards

- I. Oxygen Deficiency
  - Atmospheres containing less than 19.5 % oxygen
- II. Exposure to Toxic Contaminants
  - Some chemicals require respirator use at all times, depending on the job task
  - Other times, they may be required when you are exposed to levels above the PEL

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Toxic Contaminants

- Particulates
- Gases/Vapors
- Fumes
- Mists
- Combination of above

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Protection Factors

OSHA has assigned protection factors to each type of respirator which employers must use when selecting respirators for use

$$PF = \frac{\text{Conc. Outside Mask}}{\text{Conc. Inside Mask}}$$

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Protection Factors

Table J-3

Type of Respirator	APF*
½ mask air-purifying (HEPA filter)	10
loose-fitting hood or helmet powered air-purifying (HEPA filter)	25
hood or helmet supplied-air - continuous flow mode	25
tight-fitting powered air-purifying (HEPA)	50
full face piece air-purifying (HEPA)	50
½ mask or full face piece supplied air - continuous flow mode	50
½ mask supplied air in pressure-demand mode	1,000
full face piece supplied air in pressure-demand mode	2,000
full face piece SCBA in pressure-demand mode	>2,000

*Assigned Protection Factor

25

Half-face Negative Pressure Air-Purifying Respirator

26

Full Face Negative Pressure, Air-Purifying Respirator

27

Powered Air Purifying Respirators (PAPR)

- Powered by battery operated blowers to supply air at a positive pressure through HEPA filters to the inside of the face piece
- Provide a higher degree of protection than negative air purifying respirators, providing the battery is operating

28

Powered Air Purifying Respirator (PAPR)

29

Selection of Respiratory Equipment

- All filters, cartridges and canisters used in the workplace must be approved by NIOSH and labeled and color coded accordingly

30

Selection of Respiratory Equipment

- Cartridge replacement
  - The service life of all filters is limited by considerations of hygiene, damage, and breathing resistance
  - All filters should be replaced whenever they are damaged, soiled, or cause a noticeable increase in breathing resistance

31

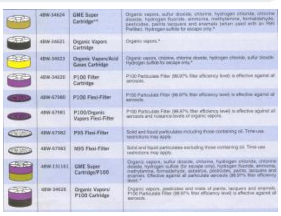
HEPA Filters

- High Efficiency Particulate Air (HEPA) filters are by definition 99.97% efficient to a particle size of 0.3 microns

Filter Series	Use	Type
N100 (99.97%) N99 N95	Non-oil aerosols	Non-specific
R100 (99.97%) R99 R95	All aerosols	Single use (8-Hrs)
P100 (99.97%) P99 P95	All aerosols	Non-specific

32

Filter Cartridge Selection



33

Limitations of Negative Pressure APRs

- They require replacement of the filters
- Filters are hazard-specific and do not protect against all contaminants
- They cannot be used in places where there is a lack of oxygen (ie, atmosphere must be between 19.5 % and 23.5 % Oxygen)
- They cannot be used in IDLH (immediately dangerous to life and health) atmospheres

34

Respirator Fitting

- Fit Tests
  - Annual (minimum)
  - Conducted by OSHA competent person
- Fit Checks
  - Every time respirator is donned
  - Done by wearer

35

Respirator Fit Testing

When respirators are used individuals must pass a fit test; initially and annually thereafter.

Two types of fit tests:

1. **Qualitative Fit Test (pass or fail)**
2. **Quantitative (how well does it fit)**

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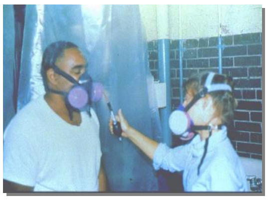
Qualitative Fit Test



37

Quantitative Fit Test

38

Fit Tests

Reasons for needing a fit test more than once per year:

- Different respirator
- Weight loss/gain of 5 lbs. or more
- Combination cartridges
- Dental work
- Facial scarring/bruising
- Broken nose/jaw

39

Respirator Fit Checks

Every time a respirator is donned (ie, put on), you must conduct a ***negative pressure and positive pressure fit check***

40

Negative Pressure Fit Check

41

Positive Pressure Fit Check

42

Requirements to Wear a Respirator

- Individuals must be medically cleared to wear any respirator prior to use
- Medical status must be reviewed annually
- Must have lung function (pulmonary function) testing
- Persons must be qualitatively or quantitatively fit tested each year
- Persons must be trained in the use and inspection of respiratory equipment

43

Other Important Issues

- Medical fitness to wear a respirator
- Facial hair & respiratory protection
- Care & cleaning of respirators
- Inspection of respirators
- Cleaning & disinfection
- Repairs
- Storage

44

RESPIRATORS…

YOUR LAST LINE OF DEFENSE

45

Medical Surveillance

- **During mold remediation projects, workers could be exposed to other substances or hazardous materials that could cause adverse health effects:**
  - Asbestos
  - Lead-based paint
  - High levels of particulates
  - Bacteria (associated with water-damaged materials, floods, sewage backups)
  - Cleaning products/biocides used as part of the projects

46

Medical Surveillance

- Mold assessment and remediation employees with persistent health problems that appear related to mold should see a physician.
- Referrals to physicians trained in occupational, environmental or allergy medicine may be needed.

47

Medical Surveillance

- There are insufficient data to determine if molds cause other adverse health effects, such as pulmonary hemorrhage, memory loss, or lethargy.[2]
- We do not know if the occurrence of mold-related illnesses is increasing.[2]
- Other than surveillance for hospital-acquired infections, there is no system to track the public's exposure to and the possible health effects of mold.[2]

48

Safety Plans

- Supervisors/Management
  - Establish safe work practices
  - Enforce safety rules and regulations
  - Train employees how to avoid hazards
  - Enforce reporting work-related injuries, illnesses, and near misses
    - Investigate causes of incidents or near misses
    - Take the appropriate action to prevent recurrence
  - Ensure prompt medical attention

49

Roles and Responsibilities

- Safety Professional
  - Develop and implement accident prevention programs
  - Advise management on company policies and governmental regulations
  - Evaluate effectiveness of existing safety programs
  - Train management in safety observation techniques

50

Why Have a Plan?

- Designed to Protect
  - Personnel
  - Environment
  - Public
  - Operation and Equipment

51

Why Have a Plan?

- Government Regulations
  - OSHA
  - EPA
  - State/Local
- Public/Private Requirements

52

Formulating the Plan

- Developing Scope of Work
- Identifying Controls for Reducing Hazards
- Reviewing Hazards of each Task
  - Physical
  - Chemical
  - Biological

53

Formulating the Plan

- Review
  - Facility
  - Operations
  - Hazardous Materials
- Points to Consider
  - Details of the Plan
  - Degree of Action Required
  - Envision Potential Incidents
  - Review Previous Incidents

54

General Requirements

- Company Policies
- Site Description, Background
- Site Security
- Emergency Response

55

Task-Specific Requirements

- Job Hazard Analysis
  - Select activities with highest risk
  - Break activity into individual components
  - Identify potential hazards in each component
  - Develop procedures to eliminate/reduce hazard

56

Typical Programs

- Recordkeeping
  - OSHA 300 log and supplementary forms
  - OSHA 301, accident investigations
  - Workers' compensation cases
  - Employee's medical history

57

Typical Programs

- Personal Protective Equipment (PPE)
  - Proper use
  - Employee training
  - Enforcement
    - Dusty Operations
    - Unknown hazards
    - Hazardous waste operations and Emergency Response

58

Typical Programs

- Hazard communication program
  - Written program development and implementation
  - Chemical Inventory
  - Communicate safe work methods for:
    - Jobs-Specific activities
    - Non-routine tasks
    - Labeling requirements
    - MSDS
    - Employee training (contractors)

59

Typical Programs

- Machine guarding
  - Make sure that machine guarding is:
    - Replaced and tested for proper function when removed for maintenance
    - Review electrical and mechanical interlocks to see if they work properly
- Equipment Repair
  - Inspect and repair and/or replaced defective parts

60

Typical Programs

- Lockout/Tagout
  - Make sure that lockout/tagout procedures are established
  - Employees trained
- Others
  - Confined-space entry
  - Excavation
  - Asbestos/Lead
  - Air monitoring

61

Implementing the Safety Plan

- Essential in reducing injuries and illnesses
- Maintains a safe environment
- Designed to protect employees, company's facilities, and local community

62

Implementing the Safety Plan

- Pre-entry briefing to alert personnel of hazards
- Conduct Job Hazard Analysis as appropriate
- Periodic safety inspection
  - Correct known deficiencies
- Must be available for review and updated as required

63

Contractor Pre-qualification

- Must complete pre-qualification
  - Incident rates
  - Experience Modification Rates (EMR)
  - OSHA recordable cases
  - General company information
  - Safety programs
  - Medical surveillance programs
  - Management philosophy

64

Project Start-Up

- Review Contractor's
  - Scope of work
  - H&S plan
- Site-Specific training
- Pre-Construction Meeting

65

Determine Contractor Relationship

- Identify who supervises contractor employees
- Must have on-site project supervisor/manager
- Must share responsibility/liability

66

Continual Improvement

- Guidelines must be created for improvement
  - Company policies
  - Contractors rules/procedures
  - H&S Plan
- Learning from mistakes
- Safety must be measured and monitored

67

On-Going Program Review

- Conduct site safety inspections
- Review training records and work permits
- Review air monitoring data
- Review how deficiencies are detected and corrected
- Conduct progress meetings

68

Protecting the Public

"Remediation Planning" (video)

69

Summary

- Eliminate hazards
- Reduce risks when hazards cannot be eliminated
- Provide warning devices
- Develop and implement standard operating procedures and training

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Summary

- Accountability must be present
- Management commitment must be visible
- Teamwork is necessary for success
- "Paper" safety programs are not acceptable
- Everybody get home safe

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NYS Mold Training Writing Plans

1

Writing Plans

- A **Mold Assessment** is completed by a Mold Assessor, who produces a…
- **Remediation Plan**, that is provided to the client before the remediation begins and is used to prepare the…
- **Remediation Work Plan**, which is the responsibility of the Remediation Contractor.
- A **Post-remediation Assessment** is completed by a Mold Assessor once remediation is complete

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Mold Assessment

- The goals for a Mold Assessment is to find the mold and determine its extent so that it can be removed in a safe manner.
- However the differences as to how to properly perform mold assessment can be substantial.
- Some, such as EPA, focus on finding the moisture and you find the mold.
- Others, such as IICRC, focus mostly on sampling to develop remediation procedures.
- We look at these differences and discuss approaches to mold assessments that are most often used by mold remediation professionals.
- We also look at NYSDOL requirements for the compiling of information for use in a Mold Remediation Plan

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Mold Assessment

Should:

- Focus on **location, identity**(type), of mold.
- Determine the **extent** (of hidden mold),and
- **origin** (cause) of mold.
- Note: sometimes these can be left to the professional remediator as the extent and origin are often at times best determined when walls are opened or baseboards removed which is rarely done for an assessment

.

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Mold Assessment

Sometimes Includes:

- A history of occupant health issues and mold sensitivities.
- Pictures of the problems / problem areas.
- Determination of Hidden Mold in Walls:

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Mold Assessment

- Some Mold Assessors attempt to determine the **extent** and **location** of hidden mold in walls by taking wall cavity samples
- Others will attempt to make such determinations by peeking behind baseboards, moving stoves, refrigerators, etc.

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Mold Assessment

- Historical information on moisture occurrences
  - (age of roof, earlier water damage claims, etc.)
- Home owner complaints about water intrusion.
- Disclaimers, limitations, and/or restrictions.

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Mold Assessment/ Mold Remediation Plan

Will in many cases contain the following information

- Lab Test results (**Identity** of mold) and interpretations
- Results of visual inspection for mold or water stains.
- Location, and type of HVAC system
- Humidity or moisture measurements

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Mold Assessment/ Mold Remediation Plan

- Determinations if any leaks were found or are still active.
- Results of testing and visual inspection,
- Recommendations as to where mold remediation
- should be performed (**Location** of mold), and;
- The **Extent** of remediation required (sq ft).
- Recommendation for Assessor called-in for post remediation Assessment/Clearance.

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Mold Assessment/ Mold Remediation Plan

- Specifics about how the remediation work should
- be done (detailed Protocol) or,
- A statement that remediation work be performed
- by a State Licensed Contractor following at minimal NYSDOL regulations and or;
  - EPA
  - NYCDOH
  - IICRC, etc guidelines.
  - Any other Federal, State, and Local requirements.

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Remediation Planning

"Remediation Planning" (video)

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Mold Remediation Plan NYSDOL

Under NYSDOL regulations a Certified Mold Assessor must Prepare a mold remediation plan that is specific to each remediation project and provide the plan to the client before the remediation begins.

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Mold Remediation Plan NYSDOL

The Mold remediation Plan must specify:

- The rooms or areas where the work will be performed
- The estimated quantities of materials to be cleaned or removed
- The methods to be used for each type of remediation in each type of area
- The personal protection equipment (PPE) to be supplied by licensed remediation contractors for use by licensed remediation workers
- The proposed clearance procedures and criteria for each type of remediation in each type of area;
- When the project is a building that is currently occupied, how to properly notify such occupants of the project.

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Mold Remediation Plan NYSDOL

- The plan must also provide recommendations for notice and posting requirements that are appropriate for the project size, duration, and points of entry.
- An estimate of cost and an estimated time frame for completion.
- The underlying sources of moisture that may be causing the mold.
- Recommendations as to the type of contractor who would remedy the source of such moisture.

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Mold Remediation Plan NYSDOL

The containment specified in the Mold Remediation Plan must prevent the spread of mold to areas of the building outside the containment under normal conditions of use

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Mold Remediation Plan NYSDOL

- A remediation plan that indicates a disinfectant, biocide, or antimicrobial coating will be used on a mold remediation project shall indicate a specific product or brand only if it is registered by the United States Environmental Protection Agency for the intended use, and if the use is consistent with the manufacturer's labeling instructions.
- A decision by a Mold Assessment Consultant to use such products must take into account the potential for occupant sensitivities

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Mold Assessment/ Mold Remediation Plan

- Recommendations on the type of documentation to be provided by Mold Remediator.
- Recommendations as to which identified problems can be handled by routine maintenance and which require the attention of a mold professional.
- Detailed evaluation of building history

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Mold Remediation Work Plan NYSDOL

- A licensed Mold Remediation Contractor will utilize the information provided by the Mold Assessment Consultant in the *Mold Remediation Plan* and generate a *Mold Remediation Work Plan* specific to each project.
- The Work Plan must fulfill all the requirements of the mold remediation plan developed by the Mold Assessment Consultant as provided to the client and provide specific instructions and/or standard operating procedures for how a mold remediation project will be performed.

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Mold Assessment/ Mold Remediation Plan

Some of the following things may not appear on all reports:

- Information on the presence of Mold Odor.
- Inspection results for hidden mold in AC or ducting beyond mold on coils.
- Reports do not typically include age of AC units and age and type of ducting (fiberglass or flex.)
- Cautions about the use of Biocides

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Review Reports

TABLE OF CONTENTS

MOLD ASSESSMENT REPORT & REMEDIATION PLAN

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Review Reports

PART 4: REMEDIATION PLAN

This plan has been prepared to meet NYSDL regulations.

A. Rooms & Areas Where Work Will Be Performed:

The work area shall be defined as the basement.

B. Estimated Quantities & Methods For Each Type of Remediation:

- **Walls, ceiling and Floor:** Remove all components with surface fungal contamination. All surfaces within the contained area should then be treated with a fungicide/biocide using disposable cloths and non-metallic brushes. After the first clean, the entire area should be high-efficiency articulate air (HEPA) vacuumed and wiped down again using disposable cloths and a disinfectant solution. After allowing the clean surface to dry, all treated areas should then be checked for moisture content and visible mold. Approximately 400 ft2 of mold to be remediated, and 1,000 ft2 of surface area to be cleaned.

C. Remediation Methods:

Remediation should be conducted consistent with the New York City Department of Health & Mental Hygiene (NYCDHMH) "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" 2008 edition for a "large area" and the Environmental Protection Agency (EPA) "Mold Remediation in Schools and Commercial Buildings" guidelines.

Disinfectants, Antimicrobials, & Coatings:

The recommended disinfectant is Foster 40/80. The recommended antimicrobial coating is Foster 40/80. This product is registered with the EPA for its intended use and should be used following the manufacturer's specifications.

The contractor is advised that all horizontal and vertical surfaces require disinfecting and cleaning using an approved fungicide. All hard surfaces should be scrubbed with non-metallic scrub brushes and sealed properly with a fungicidal coating after cleaning is complete and post-remedial clearance is achieved.

a) Porous materials:
   i. Remove all visual (active) fungal contamination.
   ii. HEPA vacuum transitory fungal accumulation.
   Porous materials are: furnishings, fabric, rugs, carpet, wall board, wall paper, plasters, batten insulation, cellulose insulation, styrofoam insulation, ceiling tiles, etc.
b) Non-porous materials:

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Review Reports

PART 4: REMEDIATION PLAN

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b) Non-porous materials:

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Review Reports

A. Personal Protective Equipment (PPE):

Personal Protective Equipment (PPE) and respiratory protection (e.g., N-95 disposable respirator) in accordance with the Occupational Safety and Health Administration (OSHA) respiratory protection standard (29 CFR 1910.134) is recommended. Gloves and eye protection should also be worn. Headgear is also required during certain applications (i.e., ceiling removal, etc.). The contractor must refer to the material data safety sheets (MSDS) for all biocide/fungicides used on the project for specific PPE guidance. PPE shall be required until clearance is achieved. All personal entering the work area are required to provide documentation of certification to the potential hazards associated with exposure to mold and use of PPE. All activities must be in compliance with the NYSDL's "Regulations for the Remediation of Mold" and the OSHA's "General Duty Clause."

B. Post-Remediation Assessment:

Visual inspection for visible accumulation of dust, debris, visible mold, and air sampling techniques shall be conducted by a NYSDL Certified Mold Assessment Consultant independent of the firm completing remediation. A presence of dust, debris, or visible mold contamination is grounds for additional cleaning. Air samples may be taken for comparison to baseline and control samples. Effective mold remediation involves reducing inside mold levels to less than or equal to typical background. A follow-up evaluation is recommended within the first six month upon completion of the mold remediation.

C. Notification & Posting:

The work area and areas directly adjacent should be unoccupied. Further vacating of spaces near the work area is recommended, including other tradesmen, recent surgical recovery patients, immune-suppressed individuals, or inflammatory disease patients during remediation efforts. The work area should be demarcated with appropriate signage and barrier tape and should remain this way until a satisfactory post-remediation clearance assessment is achieved. Signs advising that a mold remediation project is in progress shall be displayed at all accessible entrances to remediation areas.

D. Estimates of Cost & Completion Time:

A typical mold remediation project to remove mold contaminated interior components and disinfect/seal affected/adjacent areas is \$2,000-\$6,000. If the mold has caused widespread structural damage, repair costs can increase the total to \$10,000-\$30,000 or more. Considering the size and scope of this project, remediation should be completed within a week.

E. Underlying Causes:

a) Foundation damage.

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NYS Mold Training
Engineering Controls

1

HEPA Filtration

High
Efficiency
Particulate
Air

- *99.97% efficient to .3µm particle size*

2

HEPA Vacuums

3

HEPA Vacuums

- Lightly mist area with water to minimize dust levels
- Move slowly
- Vacuum all surfaces
- Use special attachments
- Maintain the vacuum in good condition

4

Portable Air Scrubbers (PAS)

- PAS units provide true 99.97% HEPA filtration and negative pressure controls in a lightweight, portable configuration that is easy to move to virtually any job site.

5

Negative Pressure Filtration Systems

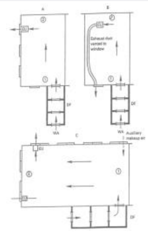
- Containment of contaminants even if the barrier is ripped or torn.
- Lower concentration of airborne contamination inside the work area
- Pressure inside the work area is lower than the pressure outside the work area

6

Negative Pressure Filtration Systems

7

Examples of Negative Pressure Systems



DF - Decontamination Facility
EU - Exhaust Unit
WA- Worker Access
A- Single room work area with multiple windows
B- Single room work area with one window
C- Large single room work area with windows and auxilliary make-up source (dotted arrow).
Arrows denote direction of air flow. Circled numbers indicate progression of removal sequence.

8

Engineering Controls

- Negative air pressure ventilation equipment to provide at least four air changes per hour
- The intake side of the machine must remain inside the area, with the opening air-tight, in order to minimize the amount of contamination on the equipment

9

Engineering Controls

10

Changing Filters

✓ Filters in the exhaust system should not be replaced after post remediation assessment is complete in order to avoid any risk of recontamination
✓ Order of filters in a negative air machine – Pre-filter, Secondary filter, HEPA filter from the ***Inlet Side*** (side the air enters)

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Power Tools with HEPA Exhaust Filtration

- Manufacturer or Aftermarket Retroifits for
  - Sanders
  - Grinders
  - Drills
  - Saws
  - Other tools

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Wet Removal Techniques

- Keep dust levels down
  - Hand (plant) sprayers
  - Pump (Chapin) sprayers
  - Low pressure sprayers
  - Sprinklers
  - Foggers & Misters

  WARNING - Too much water pressure can spread contamination

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Wet Removal Techniques

- Fogger & Misters
  - Uses commercial disinfectant
  - Small nozzle opening creates mist
  - Mist settles on all surfaces
  - Wipe down or leave as coating

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Engineering Controls

- Isolation of HVAC Systems
  - Shutdown and isolation of HVAC system
  - Local isolation and provision for temp. HVAC
  - Positive pressurization of HVAC system
- Potentially contaminated HVAC filters in existing systems shall be handled and disposed of as ACM contaminated waste

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Critical Barriers

Contractor should use critical barrier to contain work areas and prevent migration of contamination

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NYS Mold Training Documentation

1

Mold Remediation Plan NYSDOL

Under NYSDOL regulations a Certified Mold Assessment Consultant must Prepare a mold remediation plan that is specific to each remediation project and provide the plan to the client before the remediation begins.

2

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- The proposed clearance procedures and criteria for each type of remediation in each type of area;
- When the project is a building that is currently occupied, how to properly notify such occupants of the project.

3

Mold Assessment Records

Will in many cases contain the following information

- Lab Test results (**Identity** of mold) and interpretations
- Results of visual inspection for mold or water stains.
- Location, and type of HVAC system
- Humidity or moisture measurements

4

Mold Assessment Records

- Determinations if any leaks were found or are still active.
- Results of testing and visual inspection,
- Recommendations as to where mold remediation
- should be performed (**Location** of mold), and;
- The **Extent** of remediation required (sq ft).
- Recommendation for Assessor called-in for post remediation Assessment/Clearance.

5

Mold Assessment Records

- Specifics about how the remediation work should
- be done (detailed Protocol) or,
- A statement that remediation work be performed
- by a State Licensed Contractor following at minimal NYSDOL regulations and or;
  - EPA
  - NYCDOH
  - IICRC, etc guidelines.
  - Any other Federal, State, and Local requirements.

6

Mold Assessment Records

- Historical information on moisture occurrences
  - (age of roof, earlier water damage claims, etc.)
- Home owner complaints about water intrusion.
- Disclaimers, limitations, and/or restrictions.

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Mold Assessment Records

Sometimes Includes:

- A history of occupant health issues and mold sensitivities.
- Pictures of the problems / problem areas.
- Determination of Hidden Mold in Walls:

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Completing the Microbial Field Assessment Form

Site Conditions
•Exterior Conditions
•Interior Condition
•Attic/Framing/Chimney/Stairs
•Non-finished Basement
•Heating & Cooling
•Plumbing

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UNYSE ENVIRONMENTAL CONSULTANTS unyse.net

Mold Investigation Data and Observation Form

Date:
Job #:
Location:
Staff Name:

Indoor Conditions
Temperature:
Relative Humidity:

Exterior Conditions
Temperature:
Relative Humidity:
Precipitation:

Visual Inspection

Component	Visible Water Damage	Visible Mold Growth	Moisture Reading	Samples

Notes;

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Photos

A minimum of three photos in each affected room is required. Take as many additional photos as needed to capture the contents and affected areas:

•A close up of contamination
•A photo capturing the extent of the affected area
•A photo capturing the contents of the room

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Drawings

On the drawing indicate the locations of water intrusions or stains with a "O" indicate visual mold with an "X".

•Indicate the locations of photographs taken with a "P".
•Use numbers to indicate the photo number such as P1, P2, P3, etc.
•Draw a small arrow representing the direction the camera was pointing when you were taking the picture.
•Numbers must match Photo Log and Chain-of-Custody!

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Drawings

Indicate the locations and type of samples taken by:

•AS = Air •BS=Bulk
•SS =Swab •WS=Wall Check outside
•CS=Carpet

Indicate doorways, into and out of the area by using an arrow if there is no door, or a door symbol:

Indicate if doors lead directly to the outdoors.

Indicate windows by using double lines for that portion of the wall where a window is.

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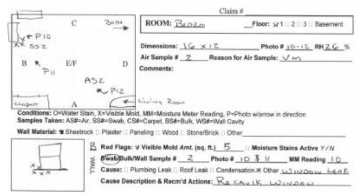
Drawings



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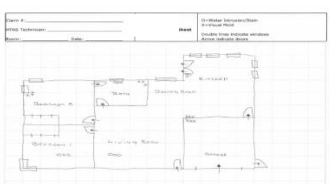
Drawings



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Mold Assessment Records

- *Sometimes* includes determination of mold on AC Coils:
- Some Mold Assessors attempt to determine the **extent** and **location** of mold in the AC and ducting by inspecting cooling coils and removing supply vents.
- In many instances the fiberglass lining of the supply plenum and the interior of the return air box (if present) are the principle locations where hidden mold accumulates in the AC system but these areas are rarely if ever checked by mold assessors or remediators.

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Mold Assessment Records

Some of the following things may not appear on all reports:

- Information on the presence of Mold Odor.
- Inspection results for hidden mold in AC or ducting beyond mold on coils.
- Reports do not typically include age of AC units and age and type of ducting (fiberglass or flex.)
- Cautions about the use of Biocides

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Mold Assessment Records

- Recommendations on the type of documentation to be provided by Mold Remediator.
- Recommendations as to which identified problems can be handled by routine maintenance and which require the attention of a mold professional.
- Detailed evaluation of building history

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Mold Remediation Work Plan NYSDOL

- A licensed Mold Remediation Contractor will utilize the information provided by the Mold Assessor in the *Mold Remediation Plan* and generate a *Mold Remediation Work Plan* specific to each project.
- The Work Plan must fulfill all the requirements of the mold remediation plan developed by the Mold Assessment Consultant as provided to the client and provide specific instructions and/or standard operating procedures for how a mold remediation project will be performed.

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Mold Remediation Work Plan NYSDOL

Also must include:

- An estimate of cost and timeframe for completion.
- When possible, the underlying sources of moisture that may be causing the mold
- Recommendation as to the type of contractor who would remedy the source of such moisture

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Post-Remediation Documentation

- NYS requirements place responsibility for remediation documentation on Mold Assessment Consultant
- Assessment Consultant shall issue a written passed clearance report to the client at the conclusion of each mold remediation project

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Post-Remediation Documentation

Remediation documentation must include:

- That there is no visible dust, dirt, or debris in the work area.
- That the underlying moisture problem was identified and eliminated.
  - If it has been determined that the underlying cause of the mold has not been remediated, the mold assessment consultant shall make a recommendation to the client as to the type of contractor who could remedy the source of the mold or moisture
- That the work area was isolated appropriately and effectively during remediation.
- That the work was completed according to the remediation plan and remediation work plan,

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Post- Remediation Documentation

Remediation documents should reflect the following at the conclusion of a project:

- That the assessor did not see or smell any mold after the abatement is complete. If you do, consider hidden mold.
- That all porous moldy materials have been removed, discarded, and replaced with clean and dry materials.
- That all non-porous, previously contaminated materials have been cleaned thoroughly.
- Make sure all water leaks and moisture problems have been fixed

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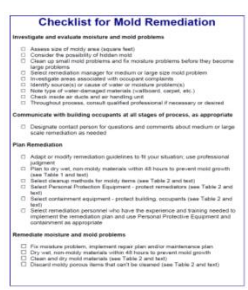
Post-Remediation Documentation


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 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 mold materials (see Table 2 and text)
- ☐ Discard moldy porous items that can't be cleaned (see Table 2 and text)

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Post-Remediation Documentation

IICRC S520 Remediation Documentation:

- Remediators remediation contract; scope of work & remediation plan.
- IEP or Hygienist remediation recommendations/protocol.
- Customer approval for any biocides used along with data sheets, how applied, length of time used, and other relevant information.
- Building history, how problem was discovered, leak detection and description of previous remediation efforts.

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Remediation Documentation

Mold Remediation Work Area
Daily Sign In Sheet

Location: Project No:

Employee Name	IN	OUT	IN	OUT

Supervisor Name: ______________ Signature: ______________

- It is important to keep an Entry/Exit daily sign-in sheet for all persons entering/exiting the remediation site.

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Documentation

•Write legibly
•Completely fill out all forms -if there is a blank, provide an explanation
•Label diagrams completely
•Note causation for all water intrusions
•Reasons for all samples
•Kind of condensation/cause
•Photo Log (must match diagrams and photos!)
•Review notes before leaving site

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Post Remediation Clearance Testing Procedures, Review Remediation Plan

1

Remediation Goals

- Eliminate contamination
- Eliminate source
- Thorough cleanup

2

Mold Remediation Plan NYSDOL

Under NYSDOL regulations a Certified Mold Assessor must Prepare a mold remediation plan that is specific to each remediation project and provide the plan to the client before the remediation begins.

3

Mold Remediation Plan NYSDOL

Must Include the proposed clearance procedures and criteria for each type of remediation in each type of area

4

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
- Discard moldy porous items that can't be cleaned

5

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6

When is The Mold Remediation Complete?

- The mold remediation process is never complete until the water or moisture problem that caused the mold to grow in the first place is fixed.
- In fact, one should never start the mold removal process until the cause of the problem is fixed.

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Clearance Testing and Procedures

- Make sure that all physical mold has been completely removed.
- It is not sufficient to simply clean and encapsulate (the use of a sealer) the mold contaminated surfaces.
- The remediatior must completely remove the mold. This may include methods such as sanding or dry ice blasting.
  - *Then an EPA approved biocide, fungicide, or disinfectant can be used to help prevent the mold from returning on the previously contaminated surfaces.*

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Post-Remediation Inspection

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Clearance Testing and Procedures

- It is vital that post-remediation clearance consider the mold that has become aerosolized (in the air).
- This mold can not be seen due to its size, and often can not be detected through your sense of smell.
- This mold can only be detected through laboratory testing which must be completed prior to beginning and after the mold remediation project.
- Sample analysis is compared against each other to determine that the air is cleaner after remediation.

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Clearance Testing and Procedures

- **Air samples** can be used to gather data about **mold** spores present in the interior of a house. These **samples** are taken by using a pump that forces **air** through a collection device which catches **mold** spores. The **sample** is then sent off to a laboratory to be analyzed.

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Sample Locations

- Samples collected for clearance should be collected in the same location and same number of samples as the background samples

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Placement of Air Samples

- Indoors, inside regulated work area
  - Collected inside the contaminated area
  - Other samples inside the building outside the contaminated area
  - Samples not to be placed in corners or near obstructions

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Placement of Air Samples

- Outdoor air samples
  - Outside the building
  - Samples to be placed 4 to 6 feet above grade level and at least 10 feet away from any obstructions that could influence wind patterns, including vents or other roof structures

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Sampling Protocols

- All project air samples must have a chain of custody
- The sampling and analytical methodology, microscope type, make and model number must be included in the analytical report
- Sampling and analytical methodology must be consistent with analysis protocol

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Sampling Techniques

- Complete chain of custody in its entirety
- Ensure accurate calibration and sample run time
  - Total Sample run time (minutes) times the average flow rate (liters/minute) = total volume (liters)

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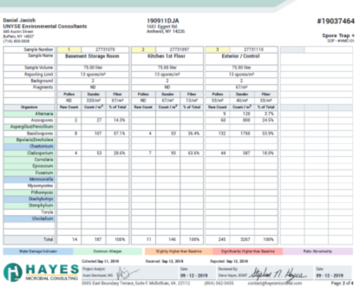
Analysis


Daniel Janish
UNYSE Environmental Consultants
345 Austin Street
Buffalo, NY 14027

190911DJA
1651 Eggert Rd.
Amherst, NY 14226

#19037464

Spore Trap +

Sample Number	1	27731070		2	27731097		3	27731110	
Sample Name	Basement Storage Room			Kitchen 1st Floor			Exterior / Control		
Sample Volume	75.00 liter			75.00 liter			75.00 liter		
Reporting Limit	13 spores/m³			13 spores/m³			13 spores/m³		
Background	2			2			2		
Fragments	ND			ND			67/m³		
	Pollen	Dander	Fiber	Pollen	Dander	Fiber	Pollen	Dander	Fiber
	ND	320/m³	67/m³	ND	67/m³	13/m³	53/m³	40/m³	53/m³
Organism	Raw Count	Count / m³	% of Total	Raw Count	Count / m³	% of Total	Raw Count	Count / m³	% of Total
Alternaria							9	120	3.7%
Ascospores	2	27	14.3%				60	800	24.5%
Aspergillus/Penicillium									
Basidiospores	8	107	57.1%	4	53	36.4%	132	1760	53.9%
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	4	53	28.6%	7	93	63.6%	44	587	18.0%
Curvularia									
Epicoccum									
Fusarium									
Memnoniella									
Myxomycetes									
Pithomyces									
Stachybotrys									
Stemphylium									
Torula									
Ulocladium									
Total	14	187	100%	11	146	100%	245	3267	100%

Water Damage Indicator | Common Allergen | Slightly Higher than Baseline | Significantly Higher than Baseline | Ratio Abnormality

HAYES MICROBIAL CONSULTING
Collected: Sep 11, 2019 Received: Sep 12, 2019 Reported: Sep 12, 2019
Date: 09 - 12 - 2019
Reviewed By: Steve Hayes, BSMT
Date: 09 - 12 - 2019
3005 East Boundary Terrace, Suite F. Midlothian, VA. 23112 (804) 562-3435 contact@hayesmicrobial.com
Page 2 of 4

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Clearance Testing and Procedures

- **Tape Lift sampling** is a simple technique, that is often used to collect settled dust **sample** from surfaces like floor, furniture, walls and even carpets. **Tape lift samples** are usually examined by light microscopy for mold, fibers, biological materials, insects and other particles found in dust.

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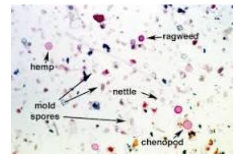
19

Mold Sample Analysis

- Laboratory analysis by light microscopy
- Accreditation through AIHA



ACCREDITED LABORATORY AIHA Environmental Microbiology See aihaLAP.org for details

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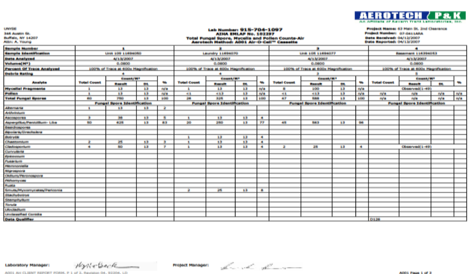
Analysis Report



AEROTECH P&K
An Affiliate of Severn Trent Laboratories, Inc.

UNYSE
346 Austin St.
Buffalo, NY 14207
Attn: A. Young

Lab Number: 915-704-1097
AIHA EMLAP No. 102297
Total Fungal Spore, Mycelia and Pollen Counts-Air
Aerotech Method: A001 Air-O-Cell™ Cassette

Project Name: 63 Main St. 2nd Clearance
Project Number: 07-0411ARA
Date Received: 04/12/2007
Date Reported: 04/13/2007

Sample Number	1				2				3				4			
Sample Identification	Unit 109 11694060				Laundry 11694070				Unit 105 11694077				Basement 116394053			
Date Analyzed	4/13/2007				4/13/2007				4/13/2007				4/13/2007			
Volume(M³)	0.0800				0.0800				0.0800				0.0800			
Percent Of Trace Analyzed	100% of Trace at 600x Magnification				100% of Trace at 600x Magnification				100% of Trace at 600x Magnification				100% of Trace at 600x Magnification			
Debris Rating	4				4				3				5			
Analyte	Total Count	Count/M³ Result	DL	%	Total Count	Count/M³ Result	DL	%	Total Count	Count/M³ Result	DL	%	Total Count	Count/M³ Result	DL	%
Mycelial Fragments	1	13	13	n/a	1	13	13	n/a	8	100	13	n/a	Observed(1-49)			
Pollen	1	13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a	n/a	n/a	n/a	n/a
Total Fungal Spores	60	750	13	100	26	325	13	100	47	588	13	100	n/a	n/a	n/a	n/a
	Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification			
Alternaria	1	13	13	2												
Arthrinium																
Ascospores	3	38	13	5	1	13	13	4								
Aspergillus/Penicillium- Like	50	625	13	83	20	250	13	77	45	563	13	96				
Basidiospores																
Bipolaris/Drechslera																
Botrytis					1	13	13	4								
Chaetomium	2	25	13	3	1	13	13	4								
Cladosporium	4	50	13	7	1	13	13	4	2	25	13	4	Observed(1-49)			
Curvularia																
Epicoccum																
Fusarium																
Memnoniella																
Nigrospora																
Oidium/Peronospora																
Pithomyces																
Rusts																
Smuts/Myxomycetes/Periconia					2	25	13	8								
Stachybotrys																
Stemphylium																
Torula																
Ulocladium																
Unclassified Conidia																
Data Qualifier													D126			

Laboratory Manager: Project Manager:

A001 AH CLIENT REPORT FORM, P 1 of 2, Revision 04, 92204, LD

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21

Post Remediation Assessment

- Assessor shall determine that the underlying cause of the mold has been remediated
- If not, assessor shall recommend other remedies
- If so, assessor issues clearance report

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Post Remediation Assessment

If the assessor determines that remediation has not been successful, the assessor shall issue a Final Status Report to the client and contractor and recommend:

- a new assessment be conducted
- The remediation plan as originally developed be completed
- The underlying causes of mold be addressed

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NYSDOL Mold Training

1-1

Contracts, Insurance and Legal Liabilities

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Contract Specifications *Learning Objectives*

1-2

- Recognize the importance of well-designed, detailed contract specifications.
- Become familiar with the key elements of contract specifications.
- Recognize the basic components of material, equipment, & substitution specifications.
- Become familiar with the importance of detailing specification for the execution of work.
- Further recognize the need for interdisciplinary approaches to mold remediation.

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The Bidding Process

1-3

- Public Bid – advertised publicly for anyone to submit a bid
- Request for Quote/Proposal – usually by invitation only (private owners only)

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Owner/Contractor Agreement

1-4

- The Contract is an agreement between parties
- Usually a four page document (separate agreement page)
- Names of the contracting parties
- Contract Amount $$$
- Start date
- Completion Date
- Terms and Conditions

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Terms and Conditions

1-5

These are the "ground rules of the contract. Examples include:

- Payment Terms
- Limitations of Liability
- Indemnification Clauses
- Hidden Conditions
- Dispute Resolution

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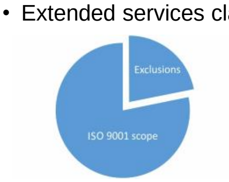
Additional Contract Elements

1-6

- Excluded services
- Extended services clauses



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Contract Specifications

1-7

American Institute of Architects

Some use "Spec Link" as a source of "boiler plate" specifications

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Contract Specifications

1-8

- Prescriptive (Means & Methods)
  Very Specific (Recipe)
- Performance
  Non-Specific: Focused on end result
- Hybrid (Combination)
  Combination of Both Performance and Prescriptive

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Contract Specifications

1-9

- Written set of standards & procedures for materials & procedures for project
- Often accompanied by "plans" or drawings
- An Addendum is a legally incorporated update to the drawings and/or specs prior to bid submittal
- A Change Order is issued after contract is awarded in order to change drawing or specs or scope of work

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Contract Specifications

1-10

- Often there are discrepancies between the specs and drawings.
- In this event, the spec should indicate which document takes precedence.

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Contract Specifications Elements

1-11

- Scope of Work addresses mold location, type of containment and restoration requirements
- Description of Work addresses route cause of moisture, possible remedies, remediation measures, and contractor requirements
- Submittals and Notices by contractor
- Building Owner requirements
- Material & Equipment specs
- Execution of Work: prep work, utilities, decon and waste disposal, respirator and clearance criteria

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Legal, Liability & Insurance Considerations

1-12

Learning Objectives

- Grasp an overview of common and statutory law, including tort litigation and regulatory compliance.
- Discover the value of recordkeeping and documentation
- Appreciate contract specifications and documents.
- Understand bonding, workers' compensation, and insurance requirements.
- Avoid legal pitfalls on mold assessment and remediation projects.

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Legal, Liability & Insurance Considerations

1-13

- Regulations & Laws
- Contracts
- Insurance
- Bonding

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13

Legal Problems With Mold

1-14

- Building owners facing the presence of mold face many problems
- Mold Professionals face three areas of potential liability:

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Legal Liabilities

1-15

- **Contractual Liability**
  - Breach of contract
- **Tort Liability**
  - Negligence or legal "wrong"
- **Regulatory Liability**
  - Non-compliance with federal, State or local regulations

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Contractual Liability (Breach of Contract)

1-16

- Work must be performed properly & on time
- Contract breached when assessor fails to outline proper protocol in remediation plan or fails to reference applicable standards or regulations
- Contract breached when contractor fails to comply with remediation plan & applicable regulations

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Tort Liability (Negligence)

1-17

- Failure to perform the work in accordance with the skills of the profession (e.g.: sleeping on the job; using untrained workers; not building proper containment)
- A legal wrong

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Regulatory Liability (Non-compliance)

1-18

- Mold contractors must comply with Federal, State and local regulations, including, but not limited to:
  - Use of personal protective equipment;
  - Remediation procedures; and
  - Properly securing and disposal of waste and debris

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Legal Problems With Mold

1-19

- **Common Law**
  - Third party can sue as intended beneficiary of contract
  - State of the art techniques
  - Negligence (failure to exercise care or breach of duty)
  - Other legal issues
  - Pollution Exclusions
  - Complications arise when applied to statuary (written) or regulatory law

19

Legal Problems With Mold

1-20

- **Statutory Law -**
  Written law set by legislature
- **Regulatory Law -**
  (promulgated by the executive branch)
  - EPA regulations
  - OSHA regulations
  - State regulations
  - Other regulations

20

Legal Counsel

1-21

Can provide valuable suggestions in the early planning stages regarding:

- insurance
- contracts
- statutory law
- potential liability
- documentation

21

Insurance

1-22

- Workers' Compensation
- General Liability Coverage
- Errors & Omissions
  - Claims Made
  - Occurrence Based
- Product Liability
- Other Concerns

22

Types of Insurance Coverage

1-23

Claims Made

- will insure for claims made during policy period (e.g.: while it is in force)
- The period of time claims can be filed against a policy can be extended by purchasing a "Tail"

23

Types of Insurance Coverage

1-24

Occurrence

- will insure for an occurrence during or after the policy period regardless of when the claim is filed
- This coverage usually expires within 1 to 2 years after the policy is no longer in effect. This is referred to as the "sunset clause"

24

Bonding

1-25

- Bid Bond (5% of Contract Amount)
- Payment Bond (100% of Contract Amount)
- Performance Bond (100% of Contract Amount)

The company that issues these bonds is called a Surety Company

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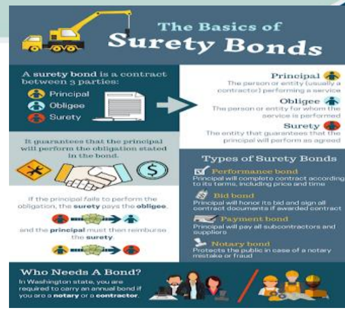
25

1-26



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Bonding

1-27

Bid Bonds:

- Used to qualify perspective bidders
- May be used to financially assist the Owner should the lowest qualified bidder refuse to accept the project for the price quoted

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Bonding

1-28

Payment Bonds:

- Also referred to as “Labor & Materials Payment Bonds”
- Ensures that the Owner can pay a contractor’s subcontractors and suppliers in the event that the contractor fails to do so

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Bonding

1-29

Performance Bond:

- Ensures that the project is completed in the event that the contractor fails to do so

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Construction Bond

1-30

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30

NYSDOL MOLD TRAINING

Prevention of IAQ Problems, Improving Maintenance and Housekeeping

1

Words of Wisdom

Who said: “An Ounce of Prevention Is Worth a Pound of Cure”?

a. Benjamin Franklin
b. Yogi Berra
c. Farmers Almanac
d. Socrates

2

Ben Franklin

Who said: “An Ounce of Prevention Is Worth a Pound of Cure”?

a. Benjamin Franklin
b. Yogi Berra
c. Farmers Almanac
d. Socrates

Methinks an Ounce Of Prevention Is Worth A Pound Of Cure…

3

Common Causes of Excessive Moisture

1. Shower Vapor Condensation
2. Plumbing Pipe Condensation
3. Toilet Bowl/Tank Condensation
4. Perimeter Wall Condensation
5. Plumbing Leaks/Flooding
6. Roof Leaks
7. Façade Leaks
8. Resident related

4

Understanding Condensation

Why does condensation form on the outside of a cold drink in the summer?

5

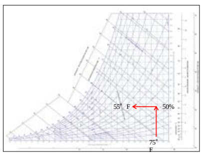
Understanding Condensation

Why does condensation form on the outside of a cold drink in the summer?

Dew point!

6

What is Dew Point?

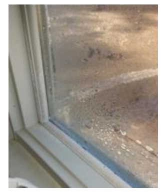


Psychometric Chart

Warm air can hold more moisture than cold air. The dew point is reached when the air is cooled to the point of saturation (100% Relative Humidity). When this occurs we call it condensation

7

Cold Weather Condensation



- Can occur when warm moist interior air contacts cooler surfaces such as windows.
- Condensation forms when the surface temperature is below the dew point temperature for the interior air

8

Warm Weather Condensation

- Can occur when warm moist interior air contacts cooler surfaces such as cold water pipes.
- Toilet tanks containing cold water often causes condensation
- Hot showers can cause condensation on "warm" surfaces

9

Shower Vapor Condensation

10

How do we Control Condensation?

Assure that bathrooms are equipped with adequate exhaust ventilation:

- Clean/uncover bathroom exhaust grills and horizontals.
- Repair rooftop exhaust fans: belts, motors, seating, timers.
- Clean and assure proper function of backflow dampers.

11

How do we Control Condensation?

How can residents help control condensation (see Controlling Mold in Your Apartment document):

- Monitor exhaust ventilation function (tissue trick) and condition of exhaust grill. Notify building maintenance staff when repairs and/or cleaning is needed.
- Discontinue the use of shower racks/clothes lines above bathtubs.
- Try to limit the length of shower time. Open bathroom windows and doors after showering.
- In the summertime, lower humidity levels in your apartment by using an air-conditioner.
- Improve general ventilation in the apartment by keeping windows open slightly at all times.

12

Controlling Shower Vapor Condensation - Exhaust Grills

13

Controlling Shower Vapor Condensation - Roof Fans

Motor Problems

Loose or Broken Belts

Broken Timers

Improper Seating of Housing

14

Controlling Shower Vapor Condensation - Backflow Dampers

15

Condensation on Cold Water Pipes In Wall Cavities

Missing insulation on cold water riser

Damaged insulation on cold water riser

Missing insulation on cold water supply

16

What's Wrong with this Wall-Break?

What Should Have Been Done Differently?

a. Check building records/ACM survey
b. Make a smaller penetration to avoid disturbing the ACM
c. Build a containment BEFORE wall break
d. All of the above

17

What's Wrong with this Wall-Break?

What Should Have Been Done Differently?

a. Check building records/ACM survey
b. Make a smaller penetration to avoid disturbing the ACM
c. Build a containment BEFORE wall break
d. All of the above

18

Toilet Condensation - In Apartment

May be caused by:

- Malfunctioning toilet hardware
- Extra cold water
- Warm ambient air temperature

19

Toilet Condensation - From Above

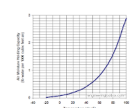
20

Perimeter Wall Condensation

21

Temperature

- As temperature changes, so does the amount of evaporation and moisture, or humidity, in the air.
- Humidity increases as temperatures cool and air approaches its dew points.
- The dew point is the temperature at which the atmosphere becomes saturated, and knowing it is critical to being able to measure humidity.



22

Relative Humidity

- Ideal relative humidity (R.H.) should be between 40% - 60%
- Avoid extremes of R.H. (< 20% and > 80%)
- Extremely low R.H. causes:
  - eyes, noses & throats to dry;
  - produces irritations & soreness;
  - increases susceptibility to infection;
  - increases problems associated with static electricity.
- High R.H. causes:
  - high moisture;
  - promotes growth of fungi and mold
- Controls:
  - Air conditioning
  - admin controls - rostering for short periods
  - install dehumidification devices

23

Relative Humidity

- The amount of moisture in the air at a given temperature, as compared with the amount of moisture the air could hold before reaching saturation at that temperature

24

Air Movement

- Too little air flow causes stuffy and uncomfortable environment;
- Too much causes draught & excessive cold.
- Internal partitioning - "dead spaces".
- Balanced Air Conditioning.
- Filter Maintenance
- ASHRAE recommends 0.35 air changes per hour, but not less than 15 cfm per person.
- Obtain expert advice:
  - Occupational Hygienist
  - Air Conditioning Engineer

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Moisture Movement Rule #1

- Liquid water will naturally tend to flow laterally and vertically downward
- It will follow the path of least resistance

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Plumbing Leaks/Flooding

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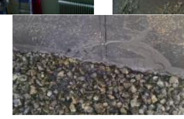
Roof Leaks



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Moisture Movement Rule #2

- Moisture will enter into porous materials due to capillary action
- A solid piece of wood will draw water up to 350-375 ft. (height of the tallest tree)
- A column of concrete placed in water will draw moisture up to 10 KM or 6 miles.

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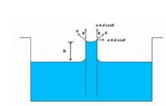
Capillary Action

- Capillary Action - The movement of a liquid along the surface of a solid caused by the greater attraction of the liquid's molecules to the surface of the solid than to each other. The liquid's molecules adhere to the solid surface and also to each other, so that each molecule pulls the next one along. Water moves through the roots of trees or into the pores of a sponge or towel by capillary action.



Capillary Action

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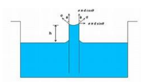
Capillary Action

- Responsible for movement of groundwater through footing (footers) into concrete wall
- Ring of dampness around base of foundation wall
- Perimeter drains help keep water away from footers



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Capillary Action

- Moisture can be drawn into an opening of 3/16" or less
- If two materials without capillary pores are placed close enough together, they create a capillary pore that can draw moisture.
- How close ?

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Capillary Action

- Answer 3/16 " or less
- The thickness of a nail or less

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Capillary Action

- Materials like overlapping siding can create capillary gaps
- Capillary rise in wood siding
- Film of water on surface of siding
- Water film draws up between laps of siding by capillary suction
- Building paper
- Sheathing

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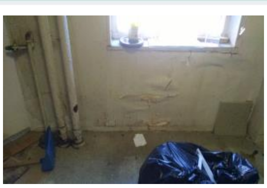
Façade Leaks



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Moisture Movement Rule #3

- Moisture moves through building materials by **vapor diffusion**
- Vapor diffusion is the movement of moisture in a vapor state as a result of a vapor pressure difference (concentration gradient)

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Moisture in Buildings

Permeability- The ability of a substance to allow another substance to pass through it, especially the ability of porous materials to transmit water through pores and cracks.

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Moisture in Buildings

Q: How much water can be collected over an entire heating season in most cold climates?

A: One-third quart of water can be collected by diffusion through a gypsum board without a vapor diffusion retarder. Whereas 30 quarts of water can be collected through air leakage.

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Moisture Movement Rule #4

Moisture moves from hot to cold

- Moisture can move through building materials by diffusion or through a hole by air transport

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Moisture Movement Rule #5

- Moisture moves from an area of higher air pressure to an area of lower air pressure
- (air transport)

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Stack Effect

Stack effect is caused by warm air rising within a structure.

- As warm air rises, it creates a higher air pressure at the ceiling area and forces air out of the building
- As the air leaves, or exfiltrates, it is displaced with outside air that is drawn into the building from the floor area (infiltrates)
- Stack effect can result in up to .5 ACH or 150 cfm in one home

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Prevention & Control Measures

- Most buildings start off wet
- All buildings get wet
- This isn't a problem so long as they dry out quickly
- It's a rate issue

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Prevention & Control Measures

- Inspection, Testing & Maintenance
- Avoid development of contamination
- Safe operating procedures
- Improved Maintenance
- Housekeeping

43

NYS MOLD Training Survey Protocol

1

Existing IAQ Investigation Protocols

- A number of protocols have been developed for investigation of a wide variety of indoor air quality problems, including microbial contamination.
- Protocols for IAQ investigations have been developed by government agencies, professional associations and private consulting firms in the United States

2

NIOSH

- The National Institute of Occupational Safety and Health (NIOSH) developed a protocol for its investigation teams, which typically include;
  - **An industrial hygienist, an epidemiologist, and a professional familiar with the operation of heating, ventilation and air conditioning (HVAC) systems.**
  - **An opening conference, a walk-through survey, personal interviews, phase I environmental monitoring, and a closing conference**

3

EPA

- The United States EPA developed a protocol in cooperation with NIOSH, for investigation of complaints by building managers. This approach involves a cycle of information gathering, hypothesis formation, and hypothesis testing. Procedures include;
  - Notification of occupants of the investigation,
  - Identification of key individuals for communication, identification of complaint areas and HVAC zones,
  - Evaluation of HVAC system deficiencies, and evaluation of pressure differences and pathways that might allow cross-contamination.

Under this protocol, air samples are recommended only after other investigative work has failed to identify problems.

4

AIHA

- A protocol developed by the American Industrial Hygiene Association (AIHA) incorporates elements of other protocols and the experience of industrial hygienists who have conducted problem-building investigations.
  - The procedure involves:
    - Intensive review of health complaints
    - Time and location patterns of affected occupants and
    - Comparison with potential sources
    - Deficiencies in ventilation and HVAC systems
    - Medical opinions about the causes of health complaints.

5

Common Elements

- Existing air quality evaluation methods and protocols have certain elements in common.
- Most include more than one stage of investigation, though the relative importance of various stages differs. Some emphasize information gathering or an initial walkthrough. Others prefer initial assessment of occupant symptoms and complaints.
- Elements such as site visits are common to all protocols.
- Assessment of occupant symptoms and complaints, and use of questionnaires and checklists, and assessment of HVAC system operation and maintenance are common to most.

6

Air Monitoring

- If required by the project, the safest way to determine fungal problems is to combine sampling protocols with a thorough building inspection, and the most useful sampling protocols combine air sampling with a thorough particulate matter (dust) sampling.

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Air Monitoring

- Air sampling alone may or may not confirm contamination, and should never be relied on to rule out colonization.
- Air samples may not accurately reflect levels of contamination or exposure, but a balanced sampling protocol prepared by an expert can be a valuable tool in predicting areas of fungal colonization.

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Visual Inspection Practices

- The level and degree of investigation required for each project will vary, but investigations may follow t three Steps depending on the situation.
- The three steps are characterized as Steps “1”, “2” and “3” in the descriptions which follow.

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Step 1 - Walk-Through Inspection

- Step A involves:
  - Visual, non-destructive inspection
  - A careful walk-through inspection will include close observation of accessible interior surfaces using common inspection tools, notes and photographs.

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Step 1 - Walk-Through Inspection

- Investigate any noticeable odors or visible evidence of fungal growth, and any blisters, stains, corrosion, deterioration, or discoloration that might indicate water intrusion or condensation problems

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Step 1 - Walk-through Inspection: Where to Look

All surfaces should be closely inspected, especially:

- seams and crevices along the base of walls
- edges of carpets
- seams of wall fabrics
- the base of all window and door jambs
- tops of walls
- joints in ceiling materials
- airstream surfaces of accessible air conditioning or humidification equipment

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Ventilation Ducts

Debris build up is common and fungal growth can attach to that debris. We must ensure that we visually verify that debris and dust has not accumulated in the ducting and providing a growth platform for mold.

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Step 1 - Walk-through Inspection: Where to Look

- Wet organic substrates are the most common amplification sites, but even elevated relative humidity or dust on hard surfaces might support growth.
- The inspector should first look for any evidence of liquid water from leaks or condensation.

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Step 2 - Invasive Inspection and Investigation

- An invasive, slightly destructive inspection should be performed when mold contamination is apparent or suspected but concealed.
- Available building plans should be reviewed in advance to identify building assemblies and locations of insulation, vapor (or air) barriers, flashing details, plumbing locations, type and distribution of HVAC systems

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15

Procedure for Inspection of Wall Cavities

Where visible contamination extends up into the wall cavity above, and where leaks from overhead roofs, decks, windows, or pipes are suspected, smaller openings should be made high on walls or ceilings, so that the leak source and extent of contamination can be identified.

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Step 2 - Invasive Inspection and Investigation

- Locations for invasive inspection are chosen where mold colonization is most likely
- Based on visual evaluation of exposed surfaces, experience with similar construction.
- Review of building plans.
- Other locations should be selected to view representative conditions where mold is not expected, to confirm its absence or identify the unexpected.

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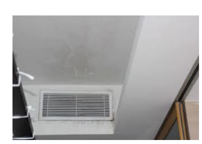
Step 2 - Invasive Inspection and Investigation : Ventilation

- Inspection should include ventilation systems where present.
- Dirty ventilation grills & ducts might be the source of contamination, or the means of its distribution between spaces, or might indirectly contribute to the concentration of indoor air contaminants by providing inadequate ventilation.



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Step 3 - Destructive Investigation and Remediation

- A complete and systematic inspection is fairly destructive, and involves opening representative building cavities and/or ventilation systems so that the extent, location, and nature of concealed mold contamination can be observed and documented with reasonable accuracy.
- This inspection level might be warranted if;
  – Concealed contamination is probable but cannot be identified using less intrusive inspection methods,
  – The need for remediation is confirmed but the location and extent cannot otherwise be determined,
  – Moisture sources cannot be identified by less intrusive observation or testing, including pipe leaks and condensation on uninsulated pipes

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Remediation Planning

- Remediation planning can begin as soon as inspection locations are documented and delineated by the inspector.
- Additional surfaces should be marked for removal to a boundary approximately 2 feet (. beyond the limits of visible contamination to assure removal of hyphal (non-sporulating) growth. If detailed documentation is required, all removal work must be done methodically and carefully, so that additional sample locations can be selected, and additional appearance notes and boundaries can be mapped on drawings.
- Materials must be placed so that it is immediately obvious where each piece of wallboard came from, until observations, sampling and documentation of that portion of the work is completed.
- Further inspection may again lead to instructions for additional removal, following the same procedures

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20

Conclusion

- Responsible and effective surveys will depend on the skill and experience of the inspector, but might also benefit from the establishment of standard protocols that can be adapted to individual project needs. Various stages of inspection and investigation may be required, depending on the complexity and extent of the problem.
- Protocols for three levels of inspection have been described for consideration or adaptation by remediation specialists
- All remediation efforts require identification of the extent and location of mold growth based on visual inspection.

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Interviewing Occupants, Questionnaire Development and Interpreting Results

1

Interviewing Occupants, Questionnaire Development and Interpreting Results

Information obtained from the owner and occupants is critical for a successful outcome

2

Interviewing Occupants, Questionnaire Development and Interpreting Results

NYSDOL considers this a "consumer protection" issue

•Provide client with NYCDOL Mold Program Fact Sheets

•Explain how the process works

3

Interviewing Occupants, Questionnaire Development and Interpreting Results

The assessor should explain NYSDOL requirements and deliverables

- –Mold assessment details
- –Mold Remediation Plan
- –Contractors responsibilities
  - •Mold Remediation Work Plan
- –Post Remediation Assessment

4

Interviewing Occupants, Questionnaire Development and Interpreting Results

The initial mold inspection is the most important part of the mold removal process. This is where a mold inspectors skill, knowledge & training come into play

5

Possible Questions

- Have you seen any visible mold growth?
- Have you noticed any odors or water accumulations (flooding, roof leaks, or condensation)?
- Have you/family members experienced any mold related symptoms?
- Where is the HVAC system located?

6

Sample Occupant Interview Form

APPENDIX A. OCCUPANT INTERVIEW FORM [Page 1]

Project name: ______
Address: ______
Name of Occupant: ______
Form applies to evaluation of: ☐ Home ☐ Workplace Date: ______
Interviewer name: ______

1. **OCCUPANT HISTORY:**
   Full name: ______
   Address/department: ______
   Phone: ______(H) ______(W)
   Fax: ______ e-mail: ______
   Age: ______ Sex: ☐ M ☐ F Occupation: ______
   Ages of family members (if home evaluation): ______
   Length of occupancy: ______ years
   Where do you spend the most of your time in the building? ______
   Smoke tobacco? ☐ Yes ☐ No Contact lenses? ☐ Yes ☐ No

2. **OCCUPANT HEALTH NOTIFICATION:**
   ☐ Distribute health notification form to building occupants

3. **BUILDING HISTORY:**
   a. Approximate age of building: ______ years
   b. Aware of any renovations or change in use? ☐ Yes ☐ No
      Approximate year and nature of renovation:
      Year: ______ Change: ______
      Year: ______ Change: ______
      Year: ______ Change: ______
      Year: ______ Change: ______
   c. Are drawings available for the building design? ☐ Yes ☐ No
      Source or location: ______

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Sample Occupant Interview Form

OCCUPANT INTERVIEW FORM [Page 2]

d. Building is: ☐Heated ☐Air conditioned ☐Naturally ventilated
   Type of HVAC system: ______
   Who maintains HVAC? ______
e. Is your building often too hot? ☐ Yes ☐ No Too cold? ☐ Yes ☐ No
   Description: ______
f. Thermostat setting ☐Constant ☐Changed at night ☐Off when away
g. Spaces are ☐Maintained at same temperature
   ☐Some are kept cooler (List)
   ______

4. **Observed Moisture and Mold or Mildew Problems**
   a. Have you ever observed any leaks or moisture problems? ☐ Yes ☐ No
      If yes, complete Moisture Event Sheet for each occurrence (page 62)
   b. Have you ever observed any mold or mildew in the building? ☐ Yes ☐ No
      If related to a moisture event, describe on the attached Moisture Event Sheet.
      Otherwise, if not apparently related to a Moisture Event, describe exact location:
      ______
   c. Are there any unpleasant odors in the building? ☐ Yes ☐ No
      ☐Musty ☐Earthy ☐Smoky ☐Dusty ☐Stale
      ☐Rotten ☐Chemical ☐Petroleum
      Other: ______
      Locations: ______
      When last noticed? ______

5. **When and where is it convenient to contact you if further questions arise?**
   ☐Day ☐Evening ☐Work ☐Home ☐Phone ☐Fax ☐e-mail
   ☐Do not contact me again

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Moisture Event Report Sample

APPENDIX A: OCCUPANT'S MOISTURE EVENT REPORT Sheet No.:_____

Consider all locations: Bathrooms, kitchen, basement, attic, crawl space, office, mechanical equipment, bedrooms, living/dining/family rooms, windows, walls, floors, ceilings, carpets, etc.
Detailed Occupant Description:

Where was it wet? (Exact location and area affected)	
Was mold observed? (Exact location and area affected, note if cleaned by owner)	

Amount of water: ☐Damp ☐Dripping / puddles ☐standing water
Probable source of moisture (occupant's opinion):
☐ leaks through walls, decks, roofing ☐ sewage backflow
☐ condensation on building surfaces ☐ condensation on pipes, ducts
☐ leaking bath, shower, plumbing ☐ wicking of moisture from soil
☐ improperly drained yard ☐ underground water table
☐ other: ______
Frequency of Wetting
☐ Almost all the time, regardless of weather
☐ Frequently, for example on most rainy days
☐ Occasionally; for example only after heavy rains
☐ Rarely or not at all
☐ Seasonal: ☐Winter ☐Spring ☐Summer ☐Fall
☐ Don't know
For how many days was it wet/damp in the past twelve months?
☐ 0-2 days ☐ 3-7 days ☐ 8-30 days ☐ More than 30 days ☐ Don't know
If currently wet, for how many days has moisture been present? ☐ not currently wet
☐ 0-2 days ☐ 3-7 days ☐ 8-30 days ☐ More than 30 days ☐ Don't know

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Interviewing Occupants, Questionnaire Development and Interpreting Results

The assessor should use the information from the interview to determine where to start the inspection

- Helps to diagnose the root cause, including possible resident cause
- Critical for preparing the Remediation Plan

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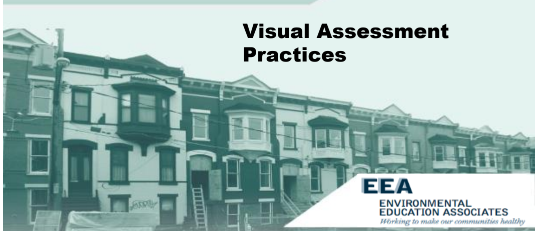
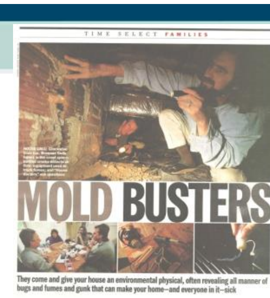


Visual Assessment Practices

1


TIME SELECT FAMILIES

MOLD BUSTERS

They come and give your house an environmental physical, often revealing all manner of bugs and fumes and gunk that can make your home—and everyone in it—sick

2

Visual Assessment Practices

Should:

- Focus on **presence** and **location** of mold.
- Determine the **extent** (of hidden mold),and **origin** (cause) of mold.

3

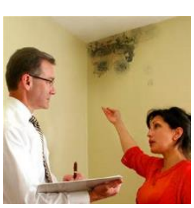
Visual Assessment Practices

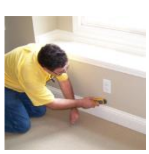
Includes:

- Determinations if any leaks were found or are still active.
- Recommendations as to where mold remediation should be performed (**Location** of mold), and the **Extent** of remediation required (sq ft).

4

Initial Assessment





5

Visual Assessment

Key Considerations during Visual Assessment;

- Detection of Odors: Certain molds can produce powerful Mycotoxin's which can throw off an odor. So if you sense a musty or earthy smell, it is a good possibility you're smelling mold.
- Discoloration: Carefully look at the discoloration. Is it black, green or white? These are the most common colors associated with mold.
- Physical Appearance: Does it appear fuzzy, cottony or leathery?

6

Visual Assessment

Key Considerations during Visual Assessments(Cont);

- Humidity Is the area you're looking at damp or is there a humidifier close by? Has there been previous water damage in the area? (Flooding) Is the suspect area in a bathroom? Does homeowner run the bathroom exhaust vent after showering? If not, the steam from showering has likely caused mold to begin growing.
- Mold Nutrients Are there cardboard boxes, old books or wood in the immediate area? These are all terrific food sources for mold to grow.

7

UNYSE ENVIRONMENTAL CONSULTANTS unyse.net

Mold Investigation Data and Observation Form

Date:
Job #:
Location:
Staff Name:

Indoor Conditions
Temperature:
Relative Humidity:

Exterior Conditions
Temperature:
Relative Humidity:
Precipitation:

Visual Inspection

Component	Visible Water Damage	Visible Mold Growth	Moisture Reading	Samples

Notes:

8

UNYSE ENVIRONMENTAL CONSULTANTS unyse.net

Mold Assessment Background Data and Observation Form

Date: ______ Project Address: ______
Project #: ______ Project Name: ______
Assessor: ______ Client: ______

Background Information

Property type (circle one): Residential or Commercial or Other Date of Construction: ______
Owner occupied or rental: ______ Is the building currently occupied? ___
Brief description of use of structure:

List Areas to be assessed if not whole structure:

Summary of interview with owner and/or occupant: Person interviewed ______

Location and Type of HVAC

Data Collection: (also complete Mold Assessment Worksheet)
Ambient Conditions (exterior):
Temperature: ______ Humidity: ______ Precipitation: ______
Interior Conditions:
Temperature: ______ Humidity: ______
Affected Area:
Temperature: ______ Humidity: ______

Notes and Observations:

Is mold remediation recommended (if so fill out Mold Remediation Plan Work Sheet) Yes or No

Signature: ______

9

UNYSE ENVIRONMENTAL CONSULTANTS unyse.net

Mold Assessment Worksheet

Date: ______ Project Address: ______ Project Name: ______
Project #: ______ Assessor: ______ Client: ______

Assessment Area (Room And floor)	Component	Visible Mold Growth (if yes quantity)	Visible Water Damage (If yes what is source)	Moisture Readings (%)	Sample # (as applicable)	Sample Type (as applicable)	Notes

Signature:

10

Red Flags

A visual assessment should be keyed into finding any red flags. A "red flag" could be considered as any situation or condition that is favorable for mold growth, has visible mold, has a history of, or is currently exhibiting water migration/intrusion:

- Moisture/Water Stains
- Damage/Deterioration allowing water in
- Visible Mold
- Sensitivity/Odors
- Requested by Insured

11

What to do when you see mold

When visible mold is detected it is more than a "Red Flag".

Visible mold requires that actions be performed. For every area in which visible mold is detected you may be required to:

- Take field measurements
- Take photos
- Measure the square foot area

12

Visual Assessment Practices

Sometimes Includes:

- Pictures of the problems / problem areas.
- Determination of Hidden Mold in Walls.

13

Boroscope

- A boroscope is a hand-held tool that allows users to see potential mold problems inside walls, ceiling plenums, crawl spaces, and other tight areas.
- It consists of a video camera on the end of a flexible "snake."
- No major drilling or cutting of dry wall is required.

14

Procedure for Assessment of Wall Cavities

- The goal is to inspect every wall cavity in the area under investigation, identify the location and extent of mold growth in each wall cavity, and delineate areas requiring remediation.
- Destructive investigation will likely result in release of contamination, so containment, safe work practices and personal protective equipment is necessary

15

Procedure for Assessment of Wall Cavities

- Where visible contamination extends up into the wall cavity above, and where leaks from overhead roofs, decks, windows, or pipes are suspected, smaller openings should be made high on walls or ceilings, so that the leak source and extent of contamination can be identified.

16

Procedure for Assessment of Wall Cavities

- A team of participants is likely to be required for a large scale investigation involving any significant portion of an occupied building.
- Detailed advanced planning is required to coordinate the work effort and anticipate project requirements in advance.
- Conditions documented as a record of the nature and extent of contamination.
- It is important to proceed methodically (especially when you are late or tired) so that each area receives the same level of attention, with the same procedures followed in the same way.
- Follow organization-based standard procedures for assessment and dust control

17

Precautions

- Investigating hidden mold problems may be difficult and will require caution when the investigation involves disturbing potential sites of mold growth.
- Safe work practices & personal protective equipment should be used if mold contamination is present that may be disturbed

18

Conclusion

- Protocol for assessment have been described for consideration or adaptation
- Responsible and effective problem evaluation will depend on the skill and experience of the inspector, but will also benefit from consistent use of standard protocols that can be adapted to individual project needs. Various steps of assessment and investigation may be required, depending on the complexity and extent of the problem.
- All assessment efforts require identification of the extent and location of mold growth and determination of root cause(s).

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Measurement Equipment

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1

Field Measurements

- Moisture meter – for moisture content in building materials
- Hygrometer – measures humidity levels
- Anemometer – quantifies ventilation rates
- Laser thermometer – records temperature at location
- Thermal Imaging – differentiates heat/cold
- Boroscope – allows video access to inaccessible areas

2

Moisture Meters

- Moisture meters measure/monitor moisture levels in building materials, and may be helpful for measuring the moisture content in a variety of building materials following water damage.
- They also can be used to monitor the progress of drying damaged materials. These direct reading devices have a thin probe that is inserted into the material to be tested or pressed directly against the surface of the material.

3

Moisture Meters

- Moisture meters can be used on materials such as carpet, wallboard, wood, brick, and concrete.

4

Moisture Meters

Material	Normal moisture reading
Interior wood and wooden furniture	6-10%
Exterior wood	6-20%
Drywall (gypsum)	0.2-1%
Concrete	0.5-1%
Plaster	0.5-1%
Brick	0.5-1%
Stone	0.5-1%
Mortar	1-4%
Stucco	0.5-2%

5

Moisture Meters

Protimeter Survey Master

Pin-probe Mode
Measurements given as % moisture

Note: Pin-probe readings can provide additional information, but are not used during the root-cause assessment.

6

Hygrometer

- A hygrometer is used to measure moisture content in the atmosphere.
- Humidity measurement instruments usually rely on measurements of some other quantity such as temperature, pressure, mass or a mechanical or electrical change in a substance as moisture is absorbed.

7

Hygrometer

- By calibration and calculation, these measured quantities can lead to a measurement of humidity

8

Anemometers

- Used for measuring the speed of air
- Vane Anemometers use a remote fan (vane) that freely rotates in response to air flow

9

Anemometers

- Used for measuring the speed of air
- Hot wire anemometers use a very fine wire, electrically heated to some temperature above the ambient and air flowing past the wire cools the wire

10

Laser Thermometer

- Used for non-contact measurements of surface temperature
- Temperatures at different surfaces can be an indication that moisture is present

11

How does Laser Thermometer work?

- By measuring the infrared energy given off by all objects, the thermometer converts the infrared energy it measures into an electrical signal, which is then displayed as a temperature.
- Link for video

12

Thermal Imaging

- Uses infrared radiation (IR) to measure heat zones of objects
- Infrared is a type of energy that is emitted from the surface of all objects and is part of the electromagnetic spectrum. This works in tandem with what is known as emissivity, or the measure of the efficiency in which a surface emits thermal energy.

13

How Do Thermal Cameras Work?

- The common standard today for thermal camera is showing warmer, objects with a yellow-orange hue that gets brighter as the object gets hotter. Colder objects are displayed with a blue or purple color.
- By rendering infrared radiation as visible light, such cameras allow users to see areas of heat through building materials, darkness, or heat-permeable barriers.

14

Comparing Heat Measuring Equipment

- Comparing video

15

Boroscope

- A boroscope is a hand-held tool that allows users to see potential mold problems inside walls, ceiling plenums, crawl spaces, and other tight areas.
- It consists of a video camera on the end of a flexible "snake."
- No major drilling or cutting of dry wall is required.

16

Boroscope

Seesnake Micro Inspection Camera

17

Initial Assessment

The initial mold assessment is the most important part of the mold removal process. This is where a mold assessors skill, knowledge & training come into play

18

Sampling Methods

1

Getting started…

2

Sampling

- Purpose
  - Detect and quantify
  - Identify sources/amplification
  - Assess potential virulence
  - Assess effectiveness of controls

3

Sampling

- Two categories of sampling
  - Air sampling
    - Indoor vs outdoor
    - Levels and types
  - Bulk and surface
    - Building materials (carpet,walls,etc.)
    - Evaluates sources

4

Approaches to Sampling

- Qualitative - Type
- Quantitative – Concentration
- Comparative – Measurements of concentrations before and after remediations and between inside and outside samples

5

Steps in Sampling

- Selection of a laboratory
- Selection of analyts
- Selection of methods
- Sensitivity of method
- Field sampling QC
- Reporting and lab support

6

Sampling Methodologies

- Most Common
  - Air Sampling
  - Spore Traps
  - Impactors
  - Sedimentation Plates
  - Swabs/Wipes
- Less Common
  - Endotoxins
  - Mycotoxins
  - Impingers
  - Ergosterol
  - MVOCs

7

Overview of Microbial Sample Collection Methods
(*Fungal Spore Sampling & Spore Traps)*

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
A	Air Sampling					
2	**Fungal Spore Sampling/Spore Traps**	Collection of fungal spores	Draw air over a sticky slide where fungal spores and other materials adhere	■ Quick turnaround time for results ■ Easy to sample ■ Identify spores which are present but no longer viable (or do not culture well) as well as viable spores ■ Method can be used to identify and quantify pollen, hyphal fragments, hair, skin cells, etc. present in the air, which can contribute to indoor air quality issues	■ Sample time is short (e.g., up to 10 minutes) ■ Can overload cassettes easily, especially if dusty or if other materials are present (pollen, mites, dander) ■ Counting errors can occur because of the presence of other particles, uneven distribution of spores, and difficult-to-see spores (transparent) ■ Cannot determine viability of spores ■ Cannot be used to identify bacteria or yeasts ■ Cannot identify specific species present ■ Many spores are morphologically similar and cannot be differentiated to the genera level (e.g., *Penicillium, Aspergillus*) ■ Genera with small spores may be underreported because they are not captured on the slide during sampling	Spores/m^3 Spores/cassette

8

Overview of Microbial Sample Collection Methods
(*Airborne Particulates & Bulk Samples*)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
A	Air Sampling					
5	**Airborne Particulate**	Collect viable and non-viable organisms and spores	Collection of airborne particulate onto a membrane filter using a pump or vacuum	■ Can identify fungi, bacteria, and yeast to the species level ■ Some operate on batteries and do not require a power source ■ Suitable for collection of a variety of organisms ■ Can sample for longer periods of time (e.g., hours to days) and can collect personal samples	■ Need a power source for some samplers ■ Sampling method can result in desiccation of organisms so they do not survive the sampling process ■ Does not indicate the presence of non-viable spores, which may be capable of producing allergies or irritation ■ Requires a minimum of seven days for incubation following sampling	mg/m^3 ng/m^3
B	Bulk Sampling					
6	**Bulk Sample of Material**	Identification of viable and non-viable organisms and spores	Collection of a bulk sample of material (e.g., drywall) for analysis	■ Suitable for identification of a variety of organisms. Can identify fungi, bacteria, and yeast to the species level if sample is cultured ■ Can analyze microscopically for fungi and bacteria to the genera level and fungal spores if analyzed microscopically ■ Quick turnaround time for microscopic analyses ■ May reveal fungal spores than have not yet become airborne ■ May reveal fungi or bacteria that are not routinely airborne	■ Sampling collection and shipment can result in desiccation of organisms so they do not survive the sampling process ■ Requires a minimum of seven days for incubation following sampling if sample is cultured ■ Do not indicate concentrations in air	CFU/g CFU/area Qualitative assessment of presence of organisms or spores.

9

Spore trap

- Air-O-Cell

10

Air Sampling

- Types of Filtration
  - Membrane filter cassette

11

Air Sampling (Spore Trap)

- Collects "everything"
  - Viable,non-viable,pollen,
- Unable to differentiate

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Overview of Microbial Sample Collection Methods (*Impactor Samplers*)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
A	Air Sampling					
3	**Impactor Samplers (e.g., Andersen, RCS, etc.)**	Collect viable and non-viable organisms and fungal spores	Draw air through sieves or slits of specific size and shape onto an agar petri dish or agar strip	■ Suitable for identification of a variety of organisms ■ Can identify fungi, bacteria, and yeast to the species level ■ Can assess the viability of organisms ■ Some samplers operate on batteries and do not require a power source ■ Some models can be used to collect different sized organisms (size fractions)	■ Sample time is short (e.g., 1 to 5 minutes) ■ Can overload the agar plates or strips ■ Need a power source for some samplers ■ Sampling for too long or at wrong flow rate can cause desiccation of organisms, or loss of organisms due to bounce ■ Limited agar media available for some models ■ Choice of sampling equipment and media can influence the sample results (e.g., MEA is a good broad spectrum agar for fungi, but slow growing fungi, such as Stachybotrys, do not grow well on it) ■ Cannot conduct personal monitoring ■ Requires the organisms or spores be alive and survive the sampling and growth process ■ Does not indicate the presence of non-viable spores, which may be capable of producing allergies or irritation ■ Requires a minimum of seven days for incubation following sampling	CFU/m^3 CFU/plate

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Plate Sampling

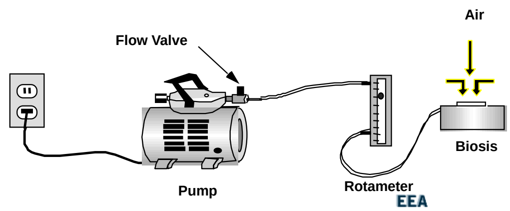

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Plate Sampling

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Plate Sampling

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Stacked Plate Samplers

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Overview of Microbial Sample Collection Methods (*Sedimentation Settling Plates*)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
A	Air Sampling					
4	**Sedimentation Settling Plates**	Collect viable and non-viable organisms and spores	Uncover agar plates and allow bioaerosols to settle onto plate	■ Easy to use, no power required ■ Suitable for collection of a variety of organisms ■ Can identify organisms to the species level	■ Can overload the agar plates ■ Sampling for too long can cause desiccation of organisms or agar ■ Cannot conduct personal monitoring ■ Requires the organisms or spores be alive and survive the sampling and growth process ■ Does not indicate the presence of non-viable spores, which may be capable of producing allergies or irritation ■ Requires a minimum of seven days for incubation following sampling ■ Generally thought to be less accurate or reliable compared with other methods, as method is gravity dependant and only captures organisms that happen to settle on the plate ■ Biased against small-spored genera such as *Aspergillus* and *Penicillium* that stay airborne longer ■ Subject to false negatives if room air is very still; species present do not culture well, or predominant species have poor dissemination in air	CFU/plate CFU/hour

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Overview of Microbial Sample Collection Methods (*Dust & Tape Lifts)*

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
B	Bulk Sampling					
7	**Dust**	Identification of viable and non-viable organisms and fungal spores in surface dust	Collection of dust sample (e.g., bulk sample) for analysis. Dust may be collected with the use of a vacuum and filter	■ Suitable for identification of a variety of organisms ■ Can identify fungi, bacteria, and yeast to the species level if sample is cultured ■ Can indicate if organisms presently, and historically, in the air have settled ■ Can be analyzed via direct microscopic examination and cultured ■ Microscopic analysis has a quick turnaround time	■ Sampling collection and shipment can result in desiccation of organisms so they do not survive the sampling process ■ The results can be difficult to interpret ■ Requires a minimum of seven days for incubation following sample collection if analyzing via culturable methods ■ Results do not indicate concentrations in air ■ Grab samples, usually, may not be representative	CFU/g Qualitative assessment of presence of organisms or spores
8	**Tape**	Identification of microbial organisms and fungal spores on surface of a material	Stick a piece of clear tape to the surface of a material, and then stick the tape to a microscope slide	■ Can identify fungi and yeasts to genera level and fungal spores in air via direct microscopic examination ■ Can sometimes identify hyphal fragments and conidia, which indicate active growth rather than just settled spores ■ Quick turnaround time on analyses ■ May reveal fungal spores than have not yet become airborne ■ May reveal fungi or bacteria that are not routinely airborne	■ The results can be difficult to interpret ■ Sample collection process can damage microbial organisms resulting in lab not being able to identify organisms ■ Results do not indicate concentrations in air ■ Grab samples usually, may not be representative. ■ Does not indicate viability of organisms.	Qualitative assessment of presence of spores, hyphae, and fruiting structures

20

Tape Lift Sampling

21

Overview of Microbial Sample Collection Methods (*Swab/Wipe & Surface Contact Plate*)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
B	Bulk Sampling					
9	**Swab / Wipe**	Identification of viable and non-viable organisms and fungal spores on the surface of a material	Use a sterile swab or a wipe moistened slightly with sterile water to sample the surface of a material	■ Suitable for identification of a variety of organisms ■ Can identify fungi, bacteria, and yeast to the species level if sample cultured ■ Quick turnaround time on direct microscopic analysis ■ May reveal fungi or bacteria that are not routinely airborne	■ Sampling collection and shipment can result in desiccation of organisms so they do not survive the sampling process ■ Requires a minimum of seven days for incubation following sampling if sample is cultured ■ Results do not indicate concentrations in air ■ Grab samples, usually, may not be representative ■ Direct microscopic examination may disturb and/or separate intact fungal structures during preparation of sample slides; therefore, direct examination seldom recommended	CFU/swab CFU/area
10	**Surface Contact Plate**	Identification of viable and non-viable organisms and fungal spores on the surface of a material	Press the surface of an agar plate against the surface of a material	■ Suitable for identification of a variety of organisms ■ Can identify fungi, bacteria, and yeast and fungal spores to the species level ■ May reveal fungi or bacteria that are not routinely airborne	■ Sampling collection and shipment can result in desiccation of organisms so they do not survive the sampling process ■ Requires a minimum of seven days for incubation following sampling if sample is cultured ■ Results do not indicate concentrations in air ■ Grab samples, usually, may not be representative	CFU/plate

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Overview of Microbial Sample Collection Methods (Water Sample & Endotoxins in air)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
C	Water Sampling					
11	**Bulk Water Sample**	Identification of microbial organisms in water samples	Collect sample of water into a clean sterilized bottle. If collecting chlorinated water samples, a chemical to neutralize the chlorine is added	■ Suitable for collection of a variety of organisms ■ Can identify fungi, bacteria, and yeast to the species level ■ May reveal fungi or bacteria that are not routinely airborne	■ Requires a minimum of seven days for incubation following sampling ■ Results do not indicate concentrations in air	CFU/ml
D	Microbial By-Products					
12	**Endotoxins in Air**	Identification of toxins associated with gram negative bacteria	Collect endotoxins onto an EndoFree polystyrene cassette using a sampling pump. Analyzed using the endotoxin-specific LAL assay	■ Method is suitable for collection of personal samples ■ There are exposure guidelines for endotoxins ■ Useful as indicator of possible gram negative bacteria contamination when growth is not visible ■ Useful in the assessment of possible health symptoms	■ Require a pump to collect samples ■ Sample results can vary between labs depending on sample cassette used, extraction, and analyses method utilized	Endotoxins Units / m^3 ng/m^3

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Overview of Microbial Sample Collection Methods (*Mycotoxins in Air*)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
D	Microbial By-Products					
13	**Mycotoxins in Air**¹	Identification of toxins produced by some fungi	Collection of mycotoxins on specialty filter cassettes using a sampling pump	■ Useful as indicator of possible fungal contamination when growth is not visible, and for assessment of possible health symptoms ■ Long-term and personal monitoring can be conducted	■ Require high levels of fungal spores to be present in air before mycotoxins can be detected with accuracy (>100,000 spores/m^3). More commonly, bulk or dust samples are analyzed ■ Absence of mycotoxins on sample results does not mean absence of fungal mass (fungi do not produce mycotoxins all the time) ■ Analysis of samples is expensive ■ Regular turnaround on samples is a minimum of five business days ■ Limited number of labs that perform mycotoxin analysis ■ List of mycotoxins analyzed for is limited ■ Analysis methods may not have been validated ■ No exposure limits or guidelines	ng/m^3

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Overview of Microbial Sample Collection Methods (*Liquid Impinger)*

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
A	Air Sampling					
1	**Liquid Impinger**	Collect viable and non-viable organisms and spores	Bubble air through a liquid medium	■ Suitable for collection of a variety of organisms ■ Can collect a greater diversity of organisms compared with other sample methods ■ Cannot be overloaded ■ Can identify fungi, bacteria, and yeast to the species level	■ Not effective for very small organisms ■ Uneven collection of fungal spores ■ Possible sterilization issues ■ More difficult to collect than other methods ■ Requires cooling packs for transport ■ Cannot conduct personal monitoring easily ■ Requires a minimum of seven days for incubation following sampling	CFU/m^3 CFU/ml

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Impinger Sampling

- Impingement
  - Liquid media
- Types of Impingers
  - AGI-30
  - AGI-4

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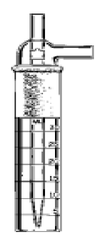
Impinger Sampling



Common Liquid Impinger Samplers:

SKC BioSampler

Omni 3000 Hi Vol. Impinger

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Overview of Microbial Sample Collection Methods (MVOC's in Air & β-1,3-D-Glucans in Air)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
D	Microbial By-Products					
14	**Microbial Volatile Organic Compounds (MVOC) in Air**	Identification of VOC associated with microbial growth	Collection of MVOC using whole air gas canister. Alternatively, collection of MVOC on an anasorb CMS sorbent tube	■ No pump or electricity required to collect samples with a whole air gas canister ■ Useful as an indicator of possible microbial contamination when growth is not visible, assessment of odours, and assessment of possible health symptoms ■ Long-term and personal monitoring can be conducted	■ Analysis of samples is expensive ■ MVOC are not unique to microorganisms; there can be many other sources of MVOC in indoor environments. Interpretation can be difficult as a result ■ Analysis typically takes 5 to 10 business days	ppm mg/m^3
15	**β-1,3-D-Glucans in Air**	Identification of β-1,3-D-glucans associated with the cell walls of fungi	Collection of β-1,3-D-glucans on a polycarbonate filter cassette using a sampling pump. Analyzed using the glucan-specific LAL assay	■ Useful as indicator of possible fungal contamination when growth is not visible, and assessment of possible symptoms (headaches and respiratory tract inflammation) ■ Long-term and personal monitoring can be conducted	■ Analysis by a laboratory required ■ Limited number of labs that perform analysis of environmental samples for β-1,3-D-glucans ■ Cannot be used to identify specific fungi or fungal spores ■ Non-fungal sources can impact results (e.g., some bacteria product glucans)	ng/m^3

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Overview of Microbial Sample Collection Methods (MVOC's in Air & β-1,3-D-Glucans in Air)

30

Microbial By Products (*Ergosterol in Air*)

Sampling Method		Purpose	Process	Advantages	Disadvantages	Results
D	Microbial By-Products					
16	**Ergosterol in Air**	Identification of ergosterol (a unique sterol associated with fungi)	Collection of ergosterol on specialty filter cassettes using a sampling pump	■ Useful as indicator of possible fungal contamination when growth is not visible, and assessment of possible symptoms ■ Long-term monitoring can be conducted	■ Analysis by a laboratory required ■ Limited number of labs that perform analysis of environmental samples for ergosterol. This analysis is seldom used in a fungal assessment ■ Cannot be used to identify specific fungi or fungal spores ■ No exposure limits or guidelines	ppm

Notes:
*Can also analyze for in bulk, surface and water samples.
CFU-colony forming units
M3-cubic metres of air
Mg-milligrams
Ng-nanograms
Ppm-parts per million
Ml-milliliter
G-gram
**References used to general Table 1 above are listed below 1-8

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Passive Sampling

Settling plates

- Settling Plates
  - Deposition of spores
  - Gravity on agar
  - Need no special instruments or equipement

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Passive Sampling

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Carpet Sampling

- Collect spores in the carpet pile using air pump
- Identifies type of mold
- Looking for uncommon types
- Provides historical information

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Carpet Sampling

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Understanding Lab Results

- It is important to note that there are no governmental-issued numerical standards for mold interpretation. However, some environmental companies, industrial hygienists, and other IAQ professionals use the following arbitrary numbers for guidance in interpreting microbial survey results.

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Bio-aerosol (Air Samples)

<250	CFU/m3	Low to Normal
250-1,000	CFU/m3	Moderate to Borderline
>1,000	CFU/m3	Active Growth to Sporulation
>5000	CFU/m3	Very Active Growth to Sporulation

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Swab Samples

- ND None Detected
- <10 Spores Rare
- 101-100 Light
- >1,000 Heavy

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Data Interpretation

- Concentration inside versus outside.
- Mold types inside versus outside.
- Presence or absence of a specific mold.
- Location of unknown source.
- Change in concentration following remediation.
- Is a "snap shot" in time.

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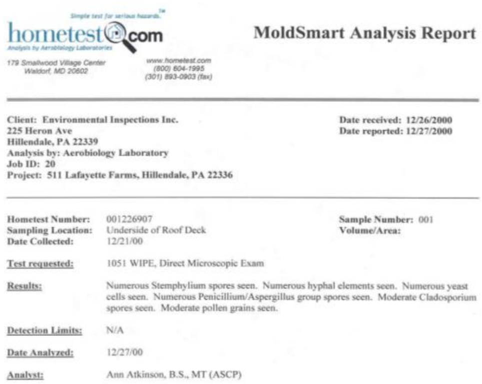
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Analysis by Aerobiology Laboratories
179 Smallwood Village Center
Waldorf, MD 20602
www.hometest.com
(800) 604-1995
(301) 893-0903 (fax)

MoldSmart Analysis Report

Client: Environmental Inspections Inc.
225 Heron Ave
Hillendale, PA 22339
Analysis by: Aerobiology Laboratory
Job ID: 20
Project: 511 Lafayette Farms, Hillendale, PA 22336

Date received: 12/26/2000
Date reported: 12/27/2000

Hometest Number: 001226907
Sampling Location: Underside of Roof Deck
Date Collected: 12/21/00

Sample Number: 001
Volume/Area:

Test requested: 1051 WIPE, Direct Microscopic Exam

Results: Numerous Stemphylium spores seen. Numerous hyphal elements seen. Numerous yeast cells seen. Numerous Penicillium/Aspergillus group spores seen. Moderate Cladosporium spores seen. Moderate pollen grains seen.

Detection Limits: N/A

Date Analyzed: 12/27/00

Analyst: Ann Atkinson, B.S., MT (ASCP)

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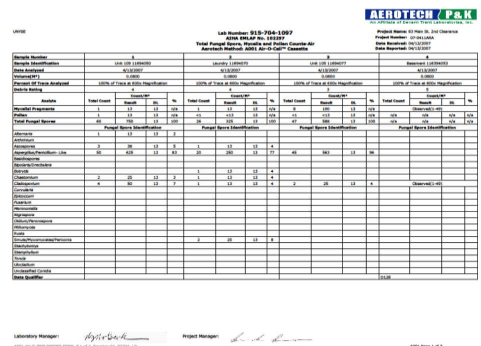

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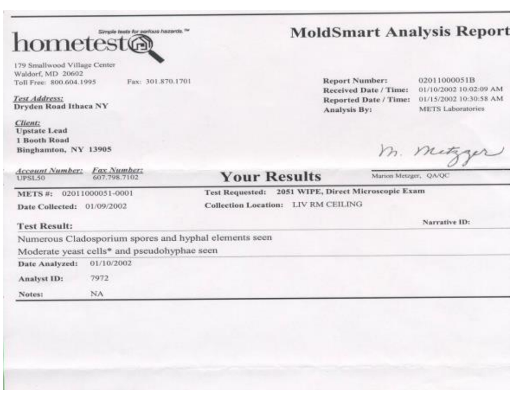
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hometest
179 Smallwood Village Center
Waldorf, MD 20602
Toll Free: 800.604.1995 Fax: 301.870.1701

MoldSmart Analysis Report

Test Address:
Dryden Road Ithaca NY

Client:
Upstate Lead
1 Booth Road
Binghamton, NY 13905

Report Number: 02011000051B
Received Date / Time: 01/10/2002 10:02:09 AM
Reported Date / Time: 01/15/2002 10:30:58 AM
Analysis By: METS Laboratories

Marion Metzger, QA/QC

Account Number: UPSL50
Fax Number: 607.798.7102

Your Results

METS #: 02011000051-0001
Date Collected: 01/09/2002
Test Requested: 2051 WIPE, Direct Microscopic Exam
Collection Location: LIV RM CEILING

Narrative ID:

Test Result:
Numerous Cladosporium spores and hyphal elements seen
Moderate yeast cells* and pseudohyphae seen
Date Analyzed: 01/10/2002
Analyst ID: 7972
Notes: NA

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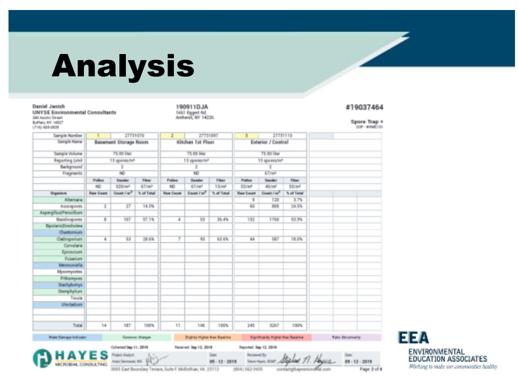

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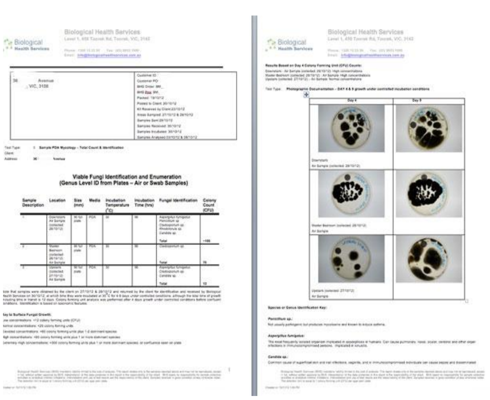

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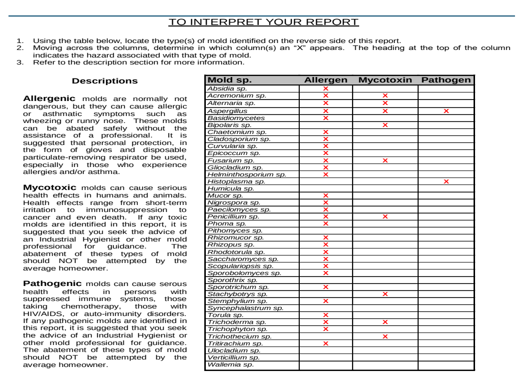
TO INTERPRET YOUR REPORT

1. Using the table below, locate the type(s) of mold identified on the reverse side of this report.
2. Moving across the columns, determine in which column(s) an "X" appears. The heading at the top of the column indicates the hazard associated with that type of mold.
3. Refer to the description section for more information.

Descriptions

Allergenic molds are normally not dangerous, but they can cause allergic or asthmatic symptoms such as wheezing or runny nose. These molds can be abated safely without the assistance of a professional. It is suggested that personal protection, in the form of gloves and disposable particulate-removing respirator be used, especially in those who experience allergies and/or asthma.

Mycotoxic molds can cause serious health effects in humans and animals. Health effects range from short-term irritation to immunosuppression to cancer and even death. If any toxic molds are identified in this report, it is suggested that you seek the advice of an Industrial Hygienist or other mold professional for guidance. The abatement of these types of mold should NOT be attempted by the average homeowner.

Pathogenic molds can cause serous health effects in persons with suppressed immune systems, those taking chemotherapy, those with HIV/AIDS, or auto-immunity disorders. If any pathogenic molds are identified in this report, it is suggested that you seek the advice of an Industrial Hygienist or other mold professional for guidance. The abatement of these types of mold should NOT be attempted by the average homeowner.

Mold sp.	Allergen	Mycotoxin	Pathogen
Absidia sp.	X		
Acremonium sp.	X	X	
Alternaria sp.	X	X	
Aspergillus	X	X	X
Basidiomycetes	X		
Bipolaris sp.		X	
Chaetomium sp.	X		
Cladosporium sp.	X		
Curvularia sp.	X		
Epicoccum sp.	X		
Fusarium sp.	X	X	
Gliocladium sp.	X		
Helminthosporium sp.	X		
Histoplasma sp.			X
Humicula sp.			
Mucor sp.	X		
Nigrospora sp.	X		
Paecilomyces sp.	X		
Penicillium sp.	X	X	
Phoma sp.	X		
Pithomyces sp.			
Rhizomucor sp.	X		
Rhizopus sp.	X		
Rhodotorula sp.	X		
Saccharomyces sp.	X		
Scopulariopsis sp.	X		
Sporobolomyces sp.	X		
Sporothrix sp.			
Sporotrichum sp.	X		
Stachybotrys sp.		X	
Stemphylium sp.	X		
Syncephalastrum sp.			
Torula sp.	X		
Trichoderma sp.	X	X	
Trichophyton sp.	X		
Trichothecium sp.		X	
Tritirachium sp.	X		
Ulocladium sp.			
Verticillium sp.			
Wallemia sp.			

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Chain of Custody

An essential part of any environmental testing program is proper documentation.

- •The Chain of Custody (COC), is created from client-supplied information
- •The section marked "Relinquished by ___"must not be omitted. *This is the person who posted the samples.*
- •Unreadable or incomplete documents are a liability in a court proceeding
- •MUST HAVE DATES!
- •Must be WRITTEN LEGIBLY

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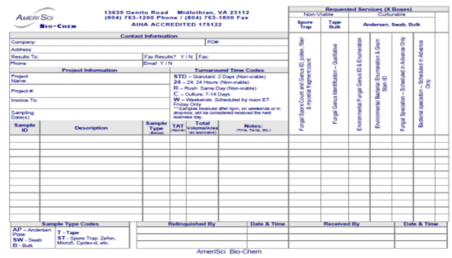
Chain of Custody



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Chain of Custody

Suggested abbreviations:

FR-Family Room	F-Front	Wa- Wall
LR-Living Room	R-Rear	SR- Sheetrock
DN-Den	LT-Left	BA-Bath
KT-Kitchen	RT-Right	DR-Dining Room
1/2- #1/#2	CL-Closet	WD-Wood
B-Basement	CG-Ceiling	N/E/W/S-North/East/West/South
BB-Baseboard	BR-Bedroom	

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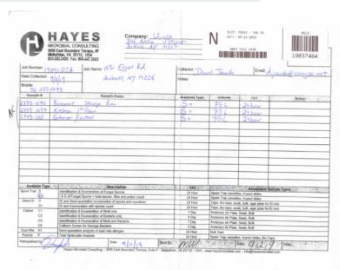
Chain of Custody



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Interpreting Data and Sampling Results

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1

Understanding Lab Results

Guidance for interperetation of mold laboratory test results;

- The final mold interpretation should not be based solely on numbers! Information gathered from a walk-through investigation of the area is very significant, including sources of moisture or high humidity, and signs of visible mold growth.
- When evaluating air samples, it is important to consider the type of concentration of fungi indoors, as compared to outdoors or a non-complaint area.

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Understanding Lab Results

- One must consider the indoor/outdoor fungal count ratio, the presence or absence of certain fungi indoors versus outdoors, the genus or species of predominant fungi indoors versus outdoors, and whether the fungi detected indoors are allergenic and or toxic.

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3

Understanding Lab Results

- It is important to note that there are no governmental-issued numerical standards for mold interpretation. However, some environmental companies, industrial hygienists, and other IAQ professionals use the following arbitrary numbers for guidance in interpreting microbial survey results.

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4

Bio-aerosol (Air Samples)

<250	CFU/m3	Low to Normal
250-1,000	CFU/m3	Moderate to Borderline
>1,000	CFU/m3	Active Growth to Sporulation
>5000	CFU/m3	Very Active Growth to Sporulation

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5

Swab Samples

• ND	None Detected
• <10	Spores Rare
• 101-100	Light
• >1,000	Heavy

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6

Data Interpretation

- Concentration inside versus outside.
- Mold types inside versus outside.
- Presence or absence of a specific mold.
- Location of unknown source.
- Change in concentration following remediation.
- Is a "snap shot" in time.

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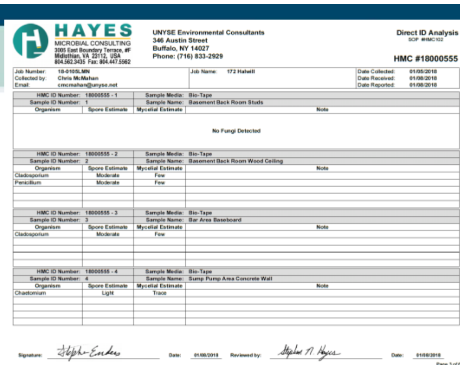
Mold Analysis Report Wall Cavity

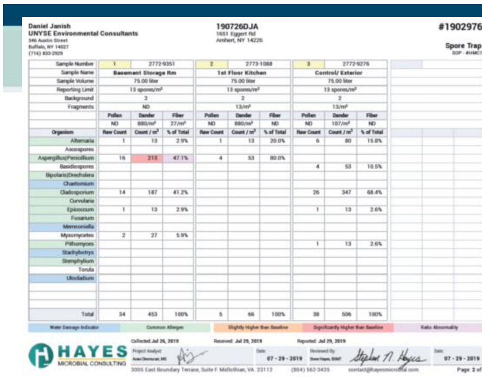
Sample Name	Outdoor		Master Closet		Living Room		Laundry Room Wall Cavity	
Sample Volume	75 Liters		75 Liters		75 Liters		30 Liters	
Limit of Detection	13 spores/M3		13 spores/M3		13 spores/M3		33 spores/M3	
Background	1+		2		2		3+	
Fragments	13 /M3		27 /M3		53 /M3		/M3	
Organism	Count / M^3	% of Total	Count / M^3	% of Total	Count / M^3	% of Total	Count / M^3	% of Total
Alternaria								
Ascospores	2560	43.4	960	47.4	1280	24.2		
Aspergillus/Penicillium	507	8.6	93	4.6	3360	63.6	382667	100.0
Basidiospores	1147	19.5	227	11.2	267	5.1		
Bipolaris/Drechslera			120	5.9	13	0.3		
Chaetomium								
Cladosporium	1653	28.1	480	23.7	333	6.3		
Curvularia			147	7.2	27	0.5		
Epicoccum								
Fusarium								
Memnoniella								
Myxomycetes	27	0.5						
Pithomyces								
Stachybotrys								
Stemphylium								
Torula								
Trichothecium								
Ulocladium								
Unidentifiable spore								
Total	5893		2027		5280		382667	

Water Damage Indicators | Common Allergens | Slightly Higher than Outside Air | Significantly Higher than Outside Air | Ratio Abnormality

8



9



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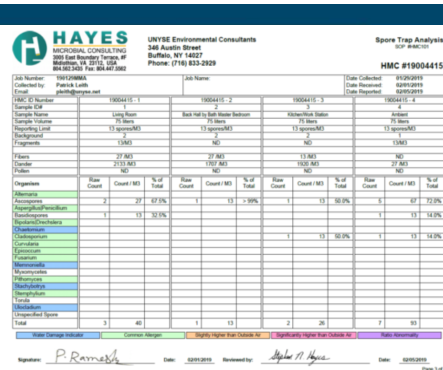

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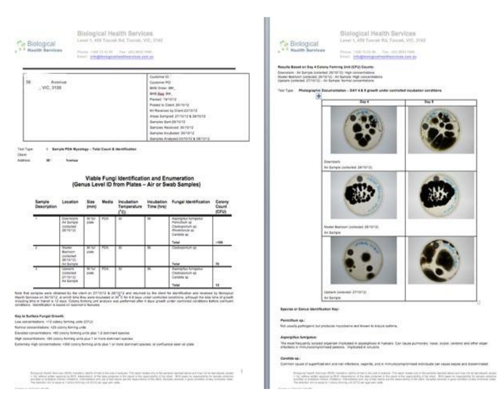

12

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Analysis by Aerobiology Laboratories

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Waldorf, MD 20602

www.hometest.com
(800) 604-1995
(301) 893-0903 (fax)

MoldSmart Analysis Report

Client: Environmental Inspections Inc.
225 Heron Ave
Hillendale, PA 22339
Analysis by: Aerobiology Laboratory
Job ID: 20
Project: 511 Lafayette Farms, Hillendale, PA 22336

Date received: 12/26/2000
Date reported: 12/27/2000

Hometest Number: 001226907
Sampling Location: Underside of Roof Deck
Date Collected: 12/21/00

Sample Number: 001
Volume/Area:

Test requested: 1051 WIPE, Direct Microscopic Exam

Results: Numerous Stemphylium spores seen. Numerous hyphal elements seen. Numerous yeast cells seen. Numerous Penicillium/Aspergillus group spores seen. Moderate Cladosporium spores seen. Moderate pollen grains seen.

Detection Limits: N/A

Date Analyzed: 12/27/00

Analyst: Ann Atkinson, B.S., MT (ASCP)

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Waldorf, MD 20602

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(800) 604-1995
(301) 893-0903 (fax)

MoldSmart Analysis Report

Client: Environmental Inspections Inc.
Smallwood Village Ctr.
Waldorf, MD 20956
Analysis by: Aerobiology Laboratory
Job ID: 20
Project: 226 Labor Way, Sigfield, VA 22331

Date received: 12/26/2000
Date reported: 01/02/2001

Hometest Number: 001226909
Sampling Location: Family Room, Indoor
Date Collected: 12/23/00

Sample Number: 001
Volume/Area: 150 L

Test Requested: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium	378	Spores/m³
Ascospores		Spores/m³
Basidiospores		Spores/m³
Smuts, Periconia, Myxomycetes		Spores/m³
Peronospora		Spores/m³
Penicillium/Aspergillus group		Spores/m³
Alternaria	54	Spores/m³
Aureobasidium		Spores/m³
Drechslera/Bipolaris group		Spores/m³
Colorless		Spores/m³
Arthrinium		Spores/m³
Botrytis		Spores/m³
Curvularia		Spores/m³
Stachybotrys	195	Spores/m³
Pollen grains		Spores/m³
Unknown	27	Spores/m³
Hyphal Elements	243	Spores/m³
Torula herbarum		Spores/m³
Bispora		Spores/m³
Chaetomium		Spores/m³
Pithomyces		Spores/m³
Epicoccum		Spores/m³
Geotrichum		Spores/m³
Rusts		Spores/m³
Spegazzinia		Spores/m³
TOTAL SPORES:	**897**	**Spores/m³**

Detection Limits: 27 Spores/m³
Notes:
Date Analyzed: 12/28/00
Analyst: Patricia R. Vestal, M.S., SM (ASCP)

page 1 of 3

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Case Studies

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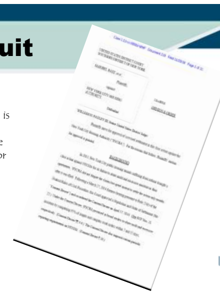
Working to make our communities healthy

1

Baez Lawsuit

Maribel Baez vs NYCHA ("Baez") is a class action lawsuit filed December 2013, as a violation the Americans with Disabilities Act for the conditions of mold and excessive moisturefor residents suffering from asthma.



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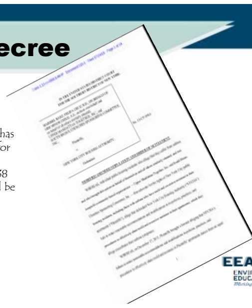
2

Consent Decree

- In partnership with the Special Master and Plaintiffs, NYCHA has revised its standard procedure for addressing mold complaints.
- These changes were piloted at 38 developments in 2017, and will be launching citywide in January 2019



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NYCHA Tech Service Mold Unit

- Mold Unit will implement NYCHA's comprehensive mold reduction strategy. Implementation begins in January 2019 and is projected to be complete by December 2019.

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4

NYCHA Tech Service Mold Unit

- Coordinate classroom training for over 2,500 operations staff, including property management and front line staff.
- Conduct field training to ensure adherence to Mold Standard Procedure and process.
- Facilitate distribution of all Mold Busters tools.
- Communicate with all NYCHA residents.
- Coordinate and prioritize mold work order scheduling to streamline repairs.

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5

NYCHA Policies

- It is the policy of NYCHA to establish a cooperative partnership between staff and residents to quickly identify mold and its root causes.
- NYCHA will promptly remove mold from NYCHA locations and identify and correct the root cause of the mold growth; i.e., the moisture source and/or inadequate ventilation.

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NYCHA Purpose

- Standard Procedures establish responsive measures to mold and its root causes in NYCHA public housing locations, and creates protocols to protect the health of residents and staff when remediating mold and identifying and correcting its root causes.

7

Standard Procedures - Inspections

All inspection work must conform to the protocols in the following documents:

- GM 040:14:1, Mold/Mildew Control in NYCHA Residential Buildings
- NextGeneration NYCHA Informer Work Management (iWM) handheld application

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Case Studies

Medical Detectives: Forensic Files
"Breaking the Mold"

9

NEW YORK STATE OF OPPORTUNITY™ | Department of Labor

Licensing of Mold Inspection, Assessment and Remediation Specialists and Minimum Work Standards

Article 32
New York State Labor Law
Effective July 28, 2015

SH 120 (12/16)

ARTICLE 32
LICENSING OF MOLD INSPECTION, ASSESSMENT AND REMEDIATION SPECIALISTS AND MINIMUM WORK STANDARDS

Title 1. Licensing of mold inspection, assessment and remediation specialists and minimum work standards (Sections 930-940.)

Section

§ 930. Definitions. As used in this article:

1. "Department" means the department of labor.
2. "Mold" means any indoor multi-cellular fungi growth capable of creating toxins that can cause pulmonary, respiratory, neurological or other major illnesses after minimal exposure, as such exposure is defined by the environmental protection agency, centers for disease control and prevention, national institute of health, or other federal, state, or local agency organized to study and/or protect human health.
3. "Mold remediation" means conducting the business of removal, cleaning, sanitizing, or surface disinfection of mold, mold containment, and waste handling of mold and materials used to remove mold from surfaces by a business enterprise, including but not limited to, sole proprietorships. Mold remediation for the purposes of this article shall not include remediation of the underlying sources of moisture that may be the cause of mold that requires expertise not specific to acts authorized under this article.
4. "Mold assessment" means an inspection or assessment of real property that is designed to discover mold, conditions that facilitate mold, indicia of conditions that are likely to facilitate mold, or any combination thereof.
5. "Mold abatement" means the act of removal, cleaning, sanitizing, or surface disinfection of mold, mold containment, and waste handling of mold and materials used to remove mold from surfaces by an individual.
6. "Project" means mold remediation, mold assessment, or mold abatement, of areas greater than ten square feet, but does not include (a) routine cleaning or (b) construction, maintenance, repair or demolition of buildings, structures or fixtures undertaken for purposes other than mold remediation or abatement.
7. "Commissioner" means the commissioner of the department of labor.

§ 931. Licensing requirements.

1. It shall be unlawful for any contractor to engage in mold assessment on a project, or to advertise or hold themselves out as a mold assessment contractor unless such contractor has a valid mold assessment license issued by the commissioner.
2. It shall be unlawful for any contractor to engage in mold remediation on a project, or to advertise or hold themselves out as a mold remediation contractor unless such contractor has a valid mold remediation license issued by the commissioner.
3. It shall be unlawful for any individual to engage in mold abatement on a project or to advertise or hold themselves out as a mold abatement worker unless such individual has a valid mold abater's license issued by the commissioner.
4. A copy of a valid mold assessment or mold remediation license must be conspicuously displayed at the work site on a mold project.
5.
   (a) Nothing in this article shall prohibit any design professional licensed pursuant to title eight of the education law from performing mold inspection, assessment, remediation and/or abatement tasks or functions if the person is acting within the scope of his or her practice, or require the design professional to obtain a license under this article for such mold inspection, assessment remediation and/or abatement tasks or functions.
   (b) Nothing in this article shall mean that any individual not licensed pursuant to title eight of the education law may perform tasks or functions limited to the scope of practice of a design professional under such title.

§932. License; procedure.

1. The commissioner shall establish minimum qualifications for licensing.
2. Applications for licenses and renewal licenses shall be submitted to the commissioner in writing on forms furnished by the commissioner and shall contain the information set forth in this section as well as any additional information that the commissioner may require.
3. An applicant for a license to perform mold assessment shall meet the following minimum requirements:
   (a) be eighteen years of age or older;
   (b) have satisfactorily completed commissioner approved course work, including training on the appropriate use and care of personal protection equipment;
   (c) paid the appropriate fees as provided in subdivision six of this section; and
   (d) submitted insurance certificates evidencing workers' compensation coverage, if required, and liability insurance of at least fifty thousand dollars providing coverage for claims arising from the licensed activities and operations performed pursuant to this article.
4. An applicant for a license to perform mold remediation shall meet the following minimum requirements:
   (a) be eighteen years of age or older;
   (b) have satisfactorily completed commissioner approved course work, including training on the appropriate use and care of personal protection equipment;
   (c) paid the appropriate fees as provided in subdivision six of this section; and
   (d) submitted insurance certificates evidencing workers' compensation coverage, if required, and liability insurance of at least fifty thousand dollars providing coverage for claims arising from the licensed activities and operations performed pursuant to this article.

5. An applicant for a license to perform mold abatement shall meet the following minimum requirements:
   (a) be eighteen years of age or older;
   (b) have satisfactorily completed commissioner approved course work, including training on the appropriate use and care of personal protection equipment; and
   (c) paid the appropriate fees as provided in subdivision six of this section.
6. The commissioner shall charge and collect the following non-refundable fees which shall accompany each application:
   (a) a fee for an initial application for a license as determined by the commissioner, of not less than five hundred dollars nor more than one thousand dollars for a mold remediation license, not less than one hundred fifty dollars nor more than three hundred dollars for a mold assessment license and not less than fifty dollars nor more than one hundred dollars for an individual mold abatement license;
   (b) a fee for renewal of a license equal to the application fee; and
   (c) a fee to be charged to a course provider for review of each course submitted for approval, as determined by the commissioner, of not less than five hundred dollars and not more than one thousand dollars, and an additional fee to be charged to a course provider of not less than one hundred dollars nor more than two hundred dollars for review of changes of technical content.

§ 933. Exemptions. The following persons shall not be required to obtain a license as provided in this title in order to perform mold assessment, remediation, or abatement:

1. a residential property owner who performs mold inspection, assessment, remediation, or abatement on his or her own property;
2. a non-residential property owner, or the employee of such owner, who performs mold assessment, remediation, or abatement on an apartment building owned by that person that has not more than four dwelling units;
3. an owner or a managing agent or a full-time employee of an owner or managing agent who performs mold assessment, remediation, or abatement on commercial property or a residential apartment building of more than four dwelling units owned by the owner provided, however, that this subdivision shall not apply if the managing agent or employee engages in the business of performing mold assessment, remediation, or abatement for the public; and
4. a federal, state or local governmental unit or public authority and employees thereof that perform mold assessment, remediation, or abatement on any property owned, managed or remediated by such governmental unit or authority.

§ 934. License issuance and renewal.

1. Licenses issued pursuant to the provisions of this title shall be valid for a period of two years from the date of issuance and may be renewed in accordance with the conditions set forth in this article and established by the commissioner.
2. Within thirty days of the receipt of the application and fee for any license issued under this section, the commissioner shall either issue the license or issue a notification of denial pursuant to subdivision one of section nine hundred thirty-eight of this title.
3. Licenses shall be in a form prescribed by the commissioner.
4. The renewal of all licenses granted under the provisions of this article shall be conditioned upon the submission of a certificate of completion of a commissioner-approved course

designed to ensure the continuing education of licensees on new and existing mold assessment and mold remediation standards.

§ 935. Practice by license holder.

1. A mold assessment license holder who intends to perform mold assessment on a mold remediation project shall prepare a work analysis for the project. The mold assessment license holder shall provide the analysis to the client before the mold remediation begins and such plan must include the analysis as defined in section nine hundred forty-five of this article.
2. A mold remediation license holder who intends to perform mold remediation shall prepare a work plan providing instructions for the remediation efforts to be performed for the mold remediation project. The mold remediation license holder shall provide the work plan to the client before the mold remediation begins. The mold remediation license holder shall maintain a copy of the work plan at the job site where the remediation is being performed.

§ 936. Licensee duties; prohibited activities.

1. A mold assessment licensee who performs mold assessment services shall provide a written report to each person for whom such licensee performs mold assessment services for compensation.
2. No licensee shall perform both mold assessment and mold remediation on the same property.
3. No person shall own an interest in both the licensee who performs mold assessment services and the licensee who performs mold remediation services on the same property.

§ 937. Civil penalties and revocation.

1. The commissioner may, after a notice and hearing, suspend or revoke any license, or censure, fine, or impose probationary or other restrictions on any licensee for good cause shown which shall include, but not be limited to the following:
   (a) conviction of a felony relating to the performance of a mold assessment or mold remediation;
   (b) deceit or misrepresentation in obtaining a license authorized under this article;
   (c) providing false testimony or documents to the commissioner in relation to a license authorized by this article or any other license issued by the commissioner;
   (d) deceiving or defrauding the public in relation to services provided for a fee that require a license; or
   (e) incompetence or gross negligence in relation to mold assessment or mold remediation.
2. Violators of any of the provisions of this article may be fined by the commissioner in an amount not to exceed two thousand dollars for the initial violation and up to ten thousand dollars for each subsequent violation.

§938. Denial of license; complaints; notice of hearing.

1. The commissioner shall, before making a determination to deny an application for a license, notify the applicant in writing of the reasons for such proposed denial and afford the applicant an opportunity to be heard in person or by counsel prior to denial of the application. Such notice shall notify the applicant that a request for a hearing must be

made within thirty days after issuance of such notification. If a hearing is requested, such hearing shall be held at such time and place as the commissioner shall prescribe.

2. If the applicant fails to make a written request for a hearing within thirty days after issuance of such notification, then the notification of denial shall become the final determination of the commissioner. The commissioner shall have subpoena powers regulated by the civil practice law and rules. If, after such hearing, the application is denied, written notice of such denial shall be served upon the applicant.
3. The commissioner shall, before revoking or suspending any license or imposing any fine as authorized by this article or reprimand on the holder thereof and at least ten days prior to the date set for the hearing, notify in writing the holder of such license, of any charges made and shall afford such person an opportunity to be heard in person or by counsel in reference thereto. No prior notice and hearing is required before the commissioner issues an order directing the cessation of unlicensed activities.
4. Written notice must be served to the licensee or person charged.
5. The hearing on such charges shall be at such time and place as the commissioner shall prescribe.

§ 939. Judicial review. The action of the commissioner in suspending, revoking or refusing to issue or renew a license, or issuing an order directing the cessation of unlicensed activity or imposing a fine or reprimand may be appealed by a proceeding brought under and pursuant to article seventy-eight of the civil practice law and rules.

§ 940. Rulemaking authority. The commissioner may adopt rules and regulations to oversee the practice of mold assessment, remediation and abatement and to ensure the health, safety and welfare of the public.

Title 2. Minimum work standards for the conduct of mold assessments and remediation by licensed persons (Sections 945-948.)

Section

§ 945. Minimum work standards for the conduct of mold assessments by licensed persons.

1. A mold assessment licensee shall prepare a mold remediation plan that is specific to each remediation project and provide the plan to the client before the remediation begins. The mold remediation plan must specify:
   (a) the rooms or areas where the work will be performed;
   (b) the estimated quantities of materials to be cleaned or removed;
   (c) the methods to be used for each type of remediation in each type of area;
   (d) the personal protection equipment (PPE) to be supplied by licensed remediators for use by licensed abaters;
   (e) the proposed clearance procedures and criteria for each type of remediation in each type of area;

(f) when the project is a building that is currently occupied, how to properly notify such occupants of such projects taking into consideration proper health concerns; the plan must also provide recommendations for notice and posting requirements that are appropriate for the project size, duration and points of entry;

(g) an estimate of cost and an estimated time frame for completion; and

(h) when possible, the underlying sources of moisture that may be causing the mold and a recommendation as to the type of contractor who would remedy the source of such moisture.

2. The remediation plan may require containment, as appropriate, to prevent the spread of mold to areas of the building outside the containment under normal conditions of use.
3. A mold assessment licensee who indicates in a remediation plan that a disinfectant, biocide, or antimicrobial coating will be used on a mold remediation project shall indicate a specific product or brand only if it is registered by the United States Environmental Protection Agency for the intended use and if the use is consistent with the manufacturer's labeling instructions. A decision by a mold assessment licensee to use such products must take into account the potential for occupant sensitivities.

§ 946. Minimum work standards for the conduct of mold remediation by licensed persons.

1. A mold remediation licensee shall prepare a mold remediation work plan that is specific to each project, fulfills all the requirements of the mold remediation plan developed by the mold assessment licensee as provided to the client and provides specific instructions and/or standard operating procedures for how a mold remediation project will be performed. The mold remediation licensee shall provide the mold remediation work plan to the client before site preparation work begins.
2. If a mold assessment licensee specifies in the mold remediation plan that personal protection equipment (PPE) is required for the project, the mold remediation licensee shall provide the specified PPE to all employees who engage in remediation activities and who will, or are anticipated to, disturb or remove mold contamination. The containment, when constructed as described in the remediation work plan and under normal conditions of use, must prevent the spread of mold to areas outside the containment.
3. Signs advising that a mold remediation project is in progress shall be displayed at all accessible entrances to remediation areas.
4. No person shall remove or dismantle any containment structures or materials from a project site prior to receipt by the mold remediation licensee overseeing the project of a notice from a mold assessment licensee that the project has achieved clearance as described in section nine hundred forty-seven of this title.
5. Disinfectants, biocides and antimicrobial coatings may be used only if their use is specified in a mold remediation plan, if they are registered by the United States Environmental Protection Agency for the intended use and if the use is consistent with the manufacturer's labeling instructions. If a plan specifies the use of such a product but does not specify the brand or type of product, a mold remediation licensee may select the brand or type of product to be used. A decision by a mold assessment or remediation licensee to use such a product must take into account the potential for occupant sensitivities and possible adverse reactions to chemicals that have the potential to be off-gassed from surfaces coated with the product.

§ 947. Post-remediation assessment and clearance.

1. For a remediated project to achieve clearance, a mold assessment licensee shall conduct a post-remediation assessment. The post-remediation assessment shall determine whether:

(a) the work area is free from all visible mold; and
(b) all work has been completed in compliance with the remediation plan and remediation work plan and meets clearance criteria specified in the plan.

2. Post-remediation assessment shall, to the extent feasible, determine that the underlying cause of the mold has been remediated so that it is reasonably certain that the mold will not return from that remediated area. If it has been determined that the underlying cause of the mold has not been remediated, the mold assessment licensee shall make a recommendation to the client as to the type of contractor who could remedy the source of the mold or the moisture causing the mold.
3. A mold assessment licensee who determines that remediation has been successful shall issue a written passed clearance report to the client at the conclusion of each mold remediation project.
4. If the mold assessment licensee determines that remediation has not been successful, the licensee shall issue a written final status report to the client and to the remediation licensee and recommend to the client that either a new assessment be conducted, that the remediation plan as originally developed be completed, or the underlying causes of mold be addressed, as appropriate.

§ 948. Investigations and complaints. The commissioner shall have the authority to inspect ongoing or completed mold assessment and mold remediation projects and to conduct an investigation upon his or her own initiation or upon receipt of a complaint by any person or entity.

Guidelines

on

Assessment and Remediation of Fungi in Indoor Environments

New York City Department of Health and Mental Hygiene

November 2008

EEA ENVIRONMENTAL EDUCATION ASSOCIATES
environmentaleducation.com

Table of Contents

Preface

This 2008 document revises existing guidelines and supersedes all prior editions. It is based both on a review of the current literature regarding fungi (mold) and on comments from a review panel consisting of experts in the fields of mycology/microbiology, environmental health sciences, environmental/occupational medicine, industrial hygiene, and environmental remediation.

These guidelines are intended for use by building owners and managers, environmental contractors and environmental consultants. It is also available for general distribution to anyone concerned about indoor mold growth. The attached fact sheet, "*Mold Growth: Prevention and Cleanup for Building Owners and Managers*," is a simplified summary of these guidelines, which may be useful for building owners, managers and workers. It is strongly recommended that the complete guidelines be referred to before addressing the assessment or remediation of indoor mold growth.

In 1993, the New York City Department of Health and Mental Hygiene (DOHMH) first issued recommendations on addressing mold growth indoors. In 2000, DOHMH made major revisions to the initial guidance and made minor edits in 2002.

The terms *fungi* and *mold* are used interchangeably throughout this document.

This document should be used only as guidance. It is not a substitute for a site-specific assessment and remediation plan and is not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites. Currently there are no United States Federal, New York State, or New York City regulations for the assessment or remediation of mold growth.

These guidelines are available to the public, but may not be reprinted or used for any commercial purpose except with the express written permission of the DOHMH. These guidelines are subject to change as more information regarding this topic becomes available.

The New York City Department of Health and Mental Hygiene would like to thank the following individuals and organizations for participating in the revision of these guidelines. Please note that these guidelines do not necessarily reflect the opinions of the participants or their organizations.

Donald Ahearn, PhD	Georgia State University
Scott Armour, MS	Armour Applied Science LLC
John Banta, CAIH	Restoration Consultants
Don Bremner	Environmental Abatement Council of Ontario – Restoration Environmental Contractors
Terry Brennan, MS	Camroden Associates Inc.
Armando Chamorro, CIH	CIH Environmental
Ginger Chew, ScD	Columbia University
Sidney Crow, PhD	Georgia State University
Susan Conrath, PhD, MPH	US Public Health Service, Indoor Environments Division
Dorr Dearborn, MD	Rainbow Childrens Hospital
Marie-Alix d'Halewyn	Institut National de Santé Publique du Québec
Eric Esswein, MPH, CIH	US National Institute for Occupational Safety and Health
Elissa Favata, MD	Environmental and Occupational Health Associates
Jean Goldberg, MS, CSP, CIH	The New York University Langone Medical Center
Ling-Ling Hung, PhD	US Public Health Service, Division of Federal Occupational Health
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Susan Klitzman, DrPH	Hunter College of the City University of New York
Laura Kolb, MPH	US Environmental Protection Agency, Indoor Environments Division
Ed Light, CIH	Building Dynamics
Bruce Lippy, PhD	The Lippy Group
Gerald Llewellyn, PhD	State of Delaware, Division of Public Health
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Philip Morey, PhD, CIH	Environ Corporation
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John Tancredi	Environmental Contractors Association of New York City – Pinnacle Environmental Corp.
Donald Weekes, CIH, CSP	InAIR Environmental Ltd.
Chin Yang, Ph.D.	Prestige EnviroMicrobiology Inc

We would also like to thank the many others who offered opinions, comments, and assistance at various stages during the development of these guidelines.

These guidelines were prepared by the Environmental and Occupational Disease Epidemiology Unit of the New York City Department of Health and Mental Hygiene. This document, and any future revisions, is available online at nyc.gov/health. For further information please call 311 or (212) NEW-YORK (from outside the City).

Introduction

Fungi (mold) are present almost everywhere. In an indoor environment hundreds of different kinds of mold are able to grow wherever there is moisture and an organic substrate (food source). They can grow on building and other materials, including: the paper on gypsum wallboard (drywall); ceiling tiles; wood products; paint; wallpaper; carpeting; some furnishings; books/papers; clothes; and other fabrics. Mold can also grow on moist, dirty surfaces such as concrete, fiberglass insulation, and ceramic tiles. It is neither possible nor warranted to eliminate the presence of all indoor fungal spores and fragments; however, mold growth indoors can and should be prevented and removed if present.

The purpose of these guidelines is to provide an approach to address potential and observed mold growth on structural materials in commercial, school, and residential buildings. Mold growth in critical care areas of health-care facilities such as intensive care units or surgery suites may pose significant health concerns to patients. This document is not intended for such situations. Please visit the US Centers for Disease Control and Prevention (CDC) at www.cdc.gov for more information on dealing with mold growth and its cleanup in health-care facilities.[1] Mold on bathroom tile grout, in shower stalls, and on bathtubs is a common occurrence. Occupants can control this growth through frequent use of household cleaners.

Water accumulation in indoor environments can lead to mold growth (and other environmental problems), which has been associated with human health effects (see ***Appendix A***).[2-6] Indoor mold growth can be prevented or minimized, however, by actively maintaining, inspecting, and correcting buildings for moisture problems and immediately drying and managing water-damaged materials. In the event that mold growth does occur, this guide is intended to assist those responsible for maintaining facilities in evaluating and correcting this problem.

Removing mold growth and correcting the underlying cause of water accumulation can help to reduce mold exposures and related health symptoms.[7,8] Prompt remediation of mold-damaged materials and infrastructure repair should be the primary response to mold growth in buildings. The simplest, most expedient remediation that properly and safely removes mold growth from buildings should be used. Extensive mold growth poses more difficult problems that should be addressed on a case-by-case basis in consultation with an appropriate building or environmental health professional. In all situations, the source of water must be identified and corrected or the mold growth will recur.

Effective communication with building occupants is an important component of all remedial efforts. Individuals who believe they have mold-related health problems should see their physicians. Individuals who may have an occupationally related illness should be referred to an occupational/environmental physician for evaluation, following any needed initial care. Clinic contact information is available from the New York State Department of Health at www.health.state.ny.us/environmental/workplace/clinic_network.

Environmental Assessment

The presence of mold growth, water damage, or musty odors should be addressed quickly. In all instances, any sources of water must be identified and corrected and the extent of water damage and any mold growth determined. Water-damaged materials should be removed or cleaned and dried. For additional information on cleaning water-damaged materials and personal belongings, refer to the EPA document "Mold Remediation in Schools and Commercial Buildings."[9]

A trained building or environmental health professional may be helpful in assessing the extent of the moisture problem and mold growth and developing a site-specific work plan. The presence of a trained professional to provide oversight during remediation can also be helpful to ensure quality work and compliance with the work plan. According to the American Industrial Hygiene Association a trained professional should have, at a minimum, a relevant science or engineering degree and two years of full-time supervised experience in mold assessment.[10]

Visual Inspection

A visual inspection is the most important initial step in identifying a possible mold problem and in determining remedial strategies. The extent of any water damage and mold growth should be visually assessed and the affected building materials identified. A visual inspection should also include observations of hidden areas where damages may be present, such as crawl spaces, attics, and behind wallboard. Carpet backing and padding, wallpaper, moldings (*e.g.* baseboards), insulation and other materials that are suspected of hiding mold growth should also be assessed.

Ceiling tiles, paper-covered gypsum wallboard (drywall), structural wood, and other cellulose-containing surfaces should be given careful attention during a visual inspection. Ventilation systems should be visually checked for damp conditions and/or mold growth on system components such as filters, insulation, and coils/fins, as well as for overall cleanliness.

Equipment such as a moisture meter or infrared camera (to detect moisture in building materials) or a borescope (to view spaces in ductwork or behind walls) may be helpful in identifying hidden sources of mold growth, the extent of water damage, and in determining if the water source is active.

Using personal protective equipment such as gloves and respiratory protection (*e.g.* N-95 disposable respirator) should be considered if assessment work might disturb mold. Efforts should also be made to minimize the generation and migration of any dust and mold.

Environmental Sampling

Environmental sampling is **not** usually necessary to proceed with remediation of visually identified mold growth or water-damaged materials. Decisions about appropriate remediation strategies can generally be made on the basis of a thorough visual inspection. Environmental sampling may be helpful in some cases, such as, to confirm the presence of visually identified

mold or if the source of perceived indoor mold growth cannot be visually identified.

If environmental samples will be collected, a sampling plan should be developed that includes a clear purpose, sampling strategy, and addresses the interpretation of results. [11,12] Many types of sampling can be performed (*e.g.* air, surface, dust, and bulk materials) on a variety of fungal components and metabolites, using diverse sampling methodologies. Sampling methods for fungi are not well standardized, however, and may yield highly variable results that can be difficult to interpret.[11-17] Currently, there are no standards, or clear and widely accepted guidelines with which to compare results for health or environmental assessments.

Environmental sampling should be conducted by an individual who is trained in the appropriate sampling methods and is aware of the limitations of the methods used. Using a laboratory that specializes in environmental mycology is also recommended. The laboratory should be accredited in microbiology by an independent and reputable certifying organization.

For additional information on sampling, refer to the American Conference of Governmental Industrial Hygienists' publication, "Bioaerosols: Assessment and Control" and the American Industrial Hygiene Association's " Field Guide for the Determination of Biological Contaminants in Environmental Samples."[11,18]

Remediation

The goal of remediation is to remove or clean mold-damaged materials using work practices that protect occupants by controlling the dispersion of mold from the work area and protect remediation workers from exposures to mold. The listed remediation methods were designed to achieve this goal; however, they are not meant to exclude other similarly effective methods and are not a substitute for a site-specific work plan. Since little scientific information exists that evaluates the effectiveness and best practices for mold remediation, these guidelines are based on principles used to remediate common indoor environmental hazards. These guidelines are not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites.

Prior to any remediation, consideration must be given to the potential presence of other environmental hazards, such as asbestos and lead. These guidelines are based on possible health risks from mold exposure and may be superseded by standard procedures for the remediation of other indoor environmental hazards.

Moisture Control and Building Repair

In all situations, the underlying moisture problem must be corrected to prevent recurring mold growth. Indoor moisture can result from numerous causes, such as: façade and roof leaks; plumbing leaks; floods; condensation; and high relative humidity. An appropriate building expert may be needed to identify and repair building problems. An immediate response

and thorough cleaning, drying, and/or removal of water-damaged materials will prevent or limit microbial growth.

Relative humidity should generally be maintained at levels below 65% to inhibit mold growth.[19] Short-term periods of higher humidity would not be expected to result in mold growth.[20] However, condensation on cold surfaces could result in water accumulation at much lower relative humidity levels. Relative humidity should be kept low enough to prevent condensation on windows and other surfaces.

Emphasis should be placed on ensuring proper repairs of the building infrastructure so that water intrusion and moisture accumulation is stopped and does not recur.

Worker Training

Proper training of workers is critical in successfully and safely remediating mold growth.[21,22] Training topics that should be addressed include:

- Causes of moisture intrusion and mold growth
- Health concerns related to mold exposure
- The use of appropriate personal protective equipment
- Mold remediation work practices, procedures, and methods

For additional information, the National Institute of Environmental Health Sciences' publication, "Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold" lists minimum training criteria for building maintenance and mold remediation workers that should be completed before addressing indoor mold growth.[23]

Trained building maintenance staff can address limited and occasional mold growth. For larger jobs, more extensively trained mold remediation workers may be needed.

Cleaning Methods

Non-porous materials (*e.g.* metals, glass, and hard plastics) can almost always be cleaned. Semi-porous and porous structural materials, such as wood and concrete can be cleaned if they are structurally sound. Porous materials, such as ceiling tiles and insulation, and wallboards (with more than a small area of mold growth) should be removed and discarded. Wallboard should be cleaned or removed at least six inches beyond visually assessed mold growth (including hidden areas, see ***Visual Inspection***) or wet or water-damaged areas.[24] A professional restoration consultant should be contacted to restore valuable items that have been damaged.

Cleaning should be done using a soap or detergent solution. Use the gentlest cleaning method that effectively removes the mold to limit dust generation. All materials to be reused should be dry and visibly free from mold. Consideration should also be given to cleaning surfaces and materials adjacent to areas of mold growth for settled spores and fungal fragments. A vacuum

equipped with a High-Efficiency Particulate Air (HEPA) filter could also be used to clean these adjacent areas.

Disinfectants are seldom needed to perform an effective remediation because removal of fungal growth remains the most effective way to prevent exposure. Disinfectant use is recommended when addressing certain specific concerns such as mold growth resulting from sewage waters. If disinfectants are considered necessary, additional measures to protect workers and occupants may also be required. Disinfectants must be registered for use by the United States Environmental Protection Agency (EPA). Any antimicrobial products used in a HVAC system must be EPA-registered specifically for that use.

The use of gaseous, vapor-phase, or aerosolized (*e.g.* fogging) biocides for remedial purposes is **not** recommended. Using biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold.

Quality Assurance Indicators

Measures to ensure the quality and effectiveness of remediation should be undertaken regardless of the project size. Evaluations *during* as well as *after* remediation should be conducted to confirm the effectiveness of remedial work, particularly for large-scale remediation. At minimum, these quality assurance indicators should be followed and documented:

- The underlying moisture problem was identified and eliminated
- Isolation of the work area was appropriate and effective
- Mold removal and worksite cleanup was performed according to the site-specific plan
- Any additional moisture or mold damage discovered during remediation was properly addressed
- Upon completion of remediation, surfaces are free from visible dust and debris.
- If environmental sampling was performed, the results of such sampling were evaluated by a trained building or environmental health professional.[10]

Restoring Treated Spaces

After completing mold remediation and correcting moisture problems, building materials that were removed should be replaced and brought to an intact and finished condition. The use of new building materials that do not promote mold growth should be considered. Anti-microbial paints are usually unnecessary after proper mold remediation. They should not be used in lieu of mold removal and proper moisture control, but may be useful in areas that are reasonably expected to be subject to moisture.

Remediation Procedures

Three different sizes of remediation and the remediation of heating, ventilation, and air-conditioning (HVAC) systems are described below. Currently, existing research does not relate the amount of mold growth to the frequency or severity of health effects. However, as the presence of moldy materials increases, so does the potential for exposure[8] and the need to limit the spread of mold-containing dusts and worker exposures. As such, the size of the area impacted by mold growth as well as practical considerations were used to help define remedial procedures.

Since the following areas were arbitrarily selected, site-specific conditions must be considered in choosing adequate remediation procedures. For more information on the unique characteristics of building types and occupancies that may influence remediation procedures refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[25]

Small Isolated Areas (less than 10 square feet) – *e.g.* ceiling tiles, small areas on walls

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) If work may impact difficult-to-clean surfaces or items (e.g. carpeting, electronic equipment), the floor of the work area, egress pathways, and other identified materials/belongings should be removed or covered with plastic sheeting and sealed with tape before remediation.

(e) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in a sealed plastic bag(s). Plastic sheeting should be discarded after use. There are no special requirements for the disposal of moldy materials.

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

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Medium-Sized Isolated Areas (10 – 100 square feet)

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) Cover the floor, egress pathways, and items left in the work area with plastic sheeting and seal with tape before remediation.

(e) Seal ventilation ducts/grills and other openings in the work area with plastic sheeting. The HVAC system servicing this area may need to be shut down to properly seal vents.

(f) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(g) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in sealed plastic bags. Plastic sheeting should be discarded after use. There are no special requirements for disposal of moldy materials.

(h) The work area and areas used by workers for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution.

(i) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Large Areas (greater than 100 square feet in a contiguous area) – *e.g.* on separate walls in a single room

Properly trained and equipped mold remediation workers should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) to provide oversight during remediation may be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

(b) Containment of the affected area:

i. The HVAC system servicing this area should be shut down during remediation.
ii. Isolation of the work area using plastic sheeting sealed with duct tape. Furnishings should be removed from the area. Ventilation ducts/grills, any other openings, and remaining fixtures/furnishings should be covered with plastic sheeting sealed with duct tape.
iii. Consider using an exhaust fan equipped with a HEPA filter to generate negative pressurization.
iv. Consider using airlocks and a clean changing room.
v. Egress pathways should also be covered if a clean changing room is not used.

(c) The work area should be unoccupied.

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) Moldy materials, that can be cleaned, should be cleaned using a soap or detergent solution. 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 soap or detergent solution or HEPA-vacuumed in the work area (or clean changing room) prior to their transport to unaffected areas of the building. There are no special requirements for the disposal of moldy materials.

(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dusts outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop with a soap or detergent solution and be visibly clean prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Remediation of HVAC Systems

Mold growth in heating, ventilation, and air-conditioning (HVAC) systems can pose building-wide problems. Obtaining professional help should always be considered in addressing even small amounts of mold growth or moisture problems within an HVAC system. Recurring problems, regardless of size, may indicate a systemic problem and appropriate professional help should be sought.

Small Isolated Area of Mold Growth in the HVAC System (<10 square feet) – *e.g.* box filter, small area on insulation

(a) Remediation can be conducted by trained building maintenance staff that are familiar with the design and function of the impacted HVAC system. Such persons should receive training on proper cleaning 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.* N-95 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) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) The use of plastic sheeting to isolate other sections of the system should be considered.

(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed and sealed in plastic bags. There are no special requirements for the disposal of moldy materials.

(g) The work area and areas used for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution. Any plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Large Area of Mold Growth in the HVAC System (>10 square feet)

Properly trained and equipped mold remediation workers with specific training and experience in HVAC systems, should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) with experience and specific knowledge of HVAC systems, to provide oversight during remediation can be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

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

(c) Containment of the affected area:

i. 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 equipped with a HEPA filter to generate negative pressurization should be considered
iii. Consider using airlocks and a clean changing room
iv. Egress pathways should also be covered if a clean changing room is not used

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that

create excessive dust should be avoided.

(e) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a soap or detergent solution or HEPA-vacuumed prior to their removal from the isolated work area. There are no special requirements for the disposal of moldy materials.

(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dust outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Communication with Building Occupants

Communication with occupants of affected spaces is important regardless of the size of the project but is especially important when mold growth requiring large-scale remediation is found. When large-scale remediation is performed, the building owner, management, and/or employer should notify occupants in the building. 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. Building occupants should be provided with a copy of all inspection reports upon request. For more detailed information on risk communication refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[26]

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Appendix A

Health Effects

Several comprehensive reviews of the scientific literature on the health effects of mold in indoor spaces have been published in recent years.[1-3] This appendix reflects these reviews but has also considered more recently published articles.

Potential for Exposure and Health Effects

Fungi are common in both indoor and outdoor environments and play a vital role in the earth's ecology by decomposing organic matter such as dead trees and leaves. As a result, all people have routine exposure to fungi, which may occur through inhalation, ingestion, and touching moldy surfaces. The main route of exposure to mold for people living or working in moldy indoor environments is inhalation of airborne fungal spores, fragments, or metabolites.[2] Ingestion and dermal exposures are less understood in these scenarios and can easily be minimized or prevented by workers through proper hygiene and work practices. Therefore, the remaining discussion will focus on the adverse health effects of mold due to inhalational exposure.

Adverse health effects may include: allergic reactions; toxic effects and irritation; and infections.[1-5] The mere presence of mold growth does not necessarily indicate that people present in the area will exhibit adverse health effects. However, as the amount of mold-impacted materials increases, so do potential exposures. Certain exposures may represent a significant risk such as occupational exposures to high concentrations of fungi and chronic (long-term) exposures, especially of individuals with underlying health conditions such as asthma, compromised immune systems, or allergies.

Evidence linking mold exposures to severe human health effects is documented in reports of occupational disease, particularly in forestry and agricultural settings where inhalation exposures were typically high and/or chronic.[2,6-11] The intensity of mold exposure and associated health effects experienced in undisturbed indoor environments is usually much less severe than that experienced by agricultural or forestry workers.[2,7,12-14] With the possible exception of exposures from mold remediation work, such high-level exposures are not expected indoors.[15-16] Although high-level exposures are unlikely to occur in undisturbed indoor settings, chronic exposures to lower levels may still raise health concerns.

Several factors influence the likelihood that individuals might experience health effects following exposure to mold in indoor environments. These include: the nature of the fungal material (e.g., allergenic, toxic/irritant, or infectious); the degree of exposure (amount and duration); and the susceptibility of exposed people. Susceptibility varies with genetic predisposition, age, state of health, concurrent exposures, and previous sensitization. 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.[17]

In addition to the adverse health effects associated with exposure to mold, in 2004, the Institute of Medicine (IOM) reported health risks associated with living in damp indoor environments. The IOM reported evidence suggesting an association between damp indoor environments and the development of asthma. Reported respiratory symptoms included, wheezing, coughing, and exacerbation of asthma.[2]

Allergic and Hypersensitivity Effects

It is well established that fungi can cause allergic reactions in humans. The most common symptoms associated with allergic reactions include runny nose, sneezing, post-nasal drip with sore throat, eye irritation, cough, wheeze, and other symptoms associated with the aggravation of asthma.[2,13,18-23] Immunological responses to mold include allergic rhinitis, hypersensitivity pneumonitis, and asthma exacerbations. These conditions require prior exposure for sensitization. These symptoms may persist for some time after removal from the source.

Allergic rhinitis is a group of symptoms that mostly affects the mucous membranes of nasal passages and may result from an allergic reaction to fungi. Symptoms often associated with "hay fever" such as congestion, runny nose, and sneezing may occur.[5,24]

Hypersensitivity pneumonitis (HP) is a rare lung disease with delayed onset (3-8 hours) of fever, shortness of breath, cough, chest tightness, chills, and general malaise. With continued exposure, HP can lead to permanent lung disease. The occurrence of HP, even among those that are highly exposed to fungi, is rare. HP has typically been associated with repeated heavy exposures in forestry and agricultural settings, which raises concerns for workers routinely performing mold remediation, but has also been reported in indoor settings with lower level chronic exposures.[3,11,18,25-27]

Allergic bronchopulmonary aspergillosis (ABPA) and allergic fungal sinusitis (AFS) are examples of rarely occurring allergic reactions to non-invasive fungal growth in the respiratory system. Most symptoms are non-specific resembling asthma or chronic sinusitis. In addition, ABPA and AFS usually occur in those with underlying medical problems. In the case of ABPA, this includes cystic fibrosis, asthma, and other predisposing medical conditions.[28,29]

Recent studies, which have suggested an association between the presence of indoor mold and the development of asthma or allergies, are limited and difficult to interpret. Stark *et al.* found higher concentrations of dust-borne mold in infants' homes were associated with development of allergic rhinitis, which is a known risk factor for childhood asthma.[24] However, other studies have shown higher concentrations of dust-borne fungi and other microorganisms in infants' homes were associated with a *decreased* risk for asthma and wheezing.[30,31] Jaakkola et al. reported an association between a moldy odor in the home and development of asthma, but no association with visible mold or water damage was found. Although the sample size for this subset was small, it suggests that active mold growth might be a stronger risk factor for certain health effects than presence of nonviable or inactive mold alone.[32] This also is supported by recent studies that have shown allergen production is significantly increased during active growth.[33,34]

Though available, allergy testing for molds is limited, subject to high rates of error, and can be difficult to interpret. Preparations for skin testing or the specific antigen in blood tests may be different from the mold to which an individual is sensitive. A positive test indicates an allergic response but does not definitively link a specific mold exposure to an individual's current health condition.[5]

Irritant and Toxic Effects

Irritant Effects

Indoor growth of mold can lead to the production of volatile organic compounds (VOCs), also referred to as microbial VOCs (MVOCs), and the presence of fungal glucans.[13,35-38] Glucans are components of many fungal cell walls. Some studies have reported an association with the inhalation of glucans and airway irritation and inflammation, but results have been mixed and may not be applicable to expected indoor concentrations. Observed effects may also be the result of exposure to or contact with other fungal components, metabolites, or synergistic effects with other microbial agents.[17,36,39] Resolution of irritant symptoms upon removal from the source can help distinguish irritant effects from allergic symptoms.[5]

MVOCs are responsible for the musty odor often associated with mold growth, which may be noticeable at very low concentrations. Many of the MVOCs are common to other sources in the home.[40] The very low levels usually found indoors have not been shown to cause health effects.[35,37]

Toxic Effects

Some symptoms and maladies have been attributed to the toxic effects of fungi in indoor environments. Certain fungi can produce toxins (mycotoxins) at varying levels that are dependent on many complex environmental and biological factors.[41] The reported symptoms from exposure to mycotoxins indoors include headaches, irritation, and nausea/loss of appetite, but are often non-specific (*e.g.* fatigue, inability to concentrate/remember), and may be caused by other environmental and non-environmental agents.[2,42-46] Although health effects from exposures to mycotoxins have been associated with certain occupational exposures or ingestion of mold-contaminated food, scientific support for the reported effects in indoor environments has not been established. This may be due to the lower levels of exposure and different routes of exposure.[2,5,13,21,27,46-49]

Stachybotrys is colloquially referred to as "black mold" or "toxic mold." It has been suggested that toxins produced by this mold are associated with specific health effects. Acute Idiopathic Pulmonary Hemorrhage (AIPH) in infants has been described in several reports suggesting a relationship with *Stachybotrys*. AIPH is an uncommon condition that results in bleeding in the lungs. The IOM reviewed the existing studies and concluded that there was insufficient evidence to determine if mold exposure was associated with AIPH.[2,3] The evidence is also insufficient for an association between inhalation of *Stachybotrys* toxins indoors and neurological damage.[2,26,49] Although severe health effects from the inhalation exposures to

Stachybotrys toxins indoors is plausible, it is not well-supported, and the issue remains controversial.[2,3,5,27,49,50]

Organic dust toxic syndrome (ODTS) describes the abrupt onset of fever, flu-like symptoms, and respiratory symptoms in the hours following a single, heavy exposure to dust-containing fungi and other microorganisms. Unlike HP, ODTS does not require repeated exposures to bioaerosols and can occur after the first exposure. ODTS has been documented in farm workers handling contaminated material, but may also affect workers performing remediation of building materials with widespread mold growth.[2,11,27] ODTS is a self-limited illness, which usually improves within 24 hours after the discontinuation of exposure. It may be underreported among workers exposed to fungi, but would not be expected in occupants of buildings with mold growth.[11,27]

Infectious Disease

Only a small number of fungi have been associated with infectious disease. Few of these fungi are typically found in the indoor environment.[51,52] Several species of *Aspergillus* are known to cause aspergillosis, most commonly *A. fumigatus*, *A. flavus*, and rarely, other species. Aspergillosis is a disease that generally affects severely immunosuppressed persons. Exposure to these molds, even in high concentrations, is unlikely to cause infection in healthy individuals.[21,53] Heavy 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. More severe health effects are primarily encountered in immunocompromised persons.[18,54]

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Preventing and Cleaning Mold Growth
Fact Sheet for Building Owners and Managers

Mold (mildew) is a fungus that can grow inside building on wet or damp surfaces. Mold can cause allergic reactions, trigger asthma attacks, or cause other health problems in some people.

Mold needs water or moisture to grow. Stop indoor mold growth by fixing leaks, drying damp or wet areas and controlling humidity. Before a clean-up, refer to the complete "Mold Guidelines" at nyc.gov/health.

PREVENT MOLD GROWTH

Fix Water Problems Immediately

- Correct water leaks.
- Dry any and all water-damaged items or areas.

Control Moisture Sources

- In bathrooms without windows, check that bathroom fans or exhaust vents are working.
- In bathrooms with windows, check that the window can be opened.
- Use a dehumidifier to lower humidity levels in basements.

CHECK THE SIZE OF THE AREA WITH MOLD GROWTH AND WATER DAMAGE

- Look for hidden mold and water damage
- If the amount of mold observed covers a large area (more than 100 square feet), is in the HVAC system, or is difficult to get to, you may need professional help.
- If there is less than 100 square feet of mold growth, trained building staff should be able to do the cleanup job.

FOLLOW THE PROPER STEPS TO CLEAN MOLD GROWTH

- Tell people living or working in the building about the plan to clean the mold growth.
- Tenants and others should leave the work area before cleaning begins.
- Cover or remove difficult-to-clean surfaces or items (e.g. carpeting, electronics) from the work area before cleaning begins.
- Use safety goggles, gloves, and a disposable respirator when removing mold growth.
- Clean mold growth with soap or a detergent, and water.
- Remove and throw away porous materials (e.g. ceiling tiles, insulation) with mold growth on them.
- Dispose of any plastic sheeting, moldy materials, and used sponges or rags in sealed heavy-duty plastic bags.
- Always fix water problems immediately. If the mold returns quickly or spreads, you may have an ongoing water problem.

If more than 10 square feet of mold growth is present also:

- Cover the floor in the work area with plastic sheeting.
- Cover entry and exit pathways with plastic sheeting.
- Seal any ventilation ducts with plastic sheeting.
- Mop and/or HEPA-vacuum the work area and pathways.

CLEAN MOLD GROWTH WITH PROPER SUPPLIES

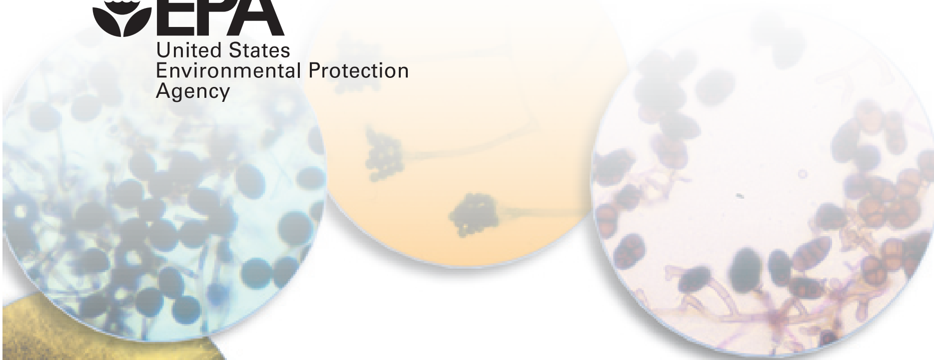
- Soap or detergent
- Disposable rags/sponges and scrub brush
- Buckets
- Heavy-duty plastic garbage bags
- Protective gear (e.g. goggles, rubber gloves, N95 respirator)

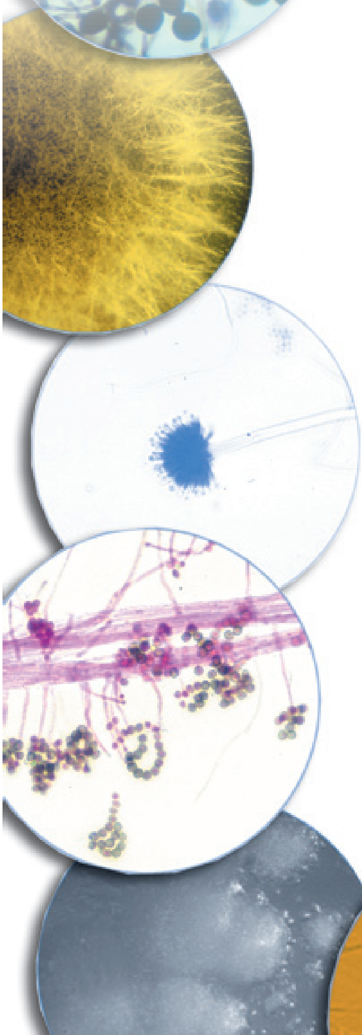
FOR MORE INFORMATION

Visit our web site at **nyc.gov/health** for the complete "Mold Guidelin

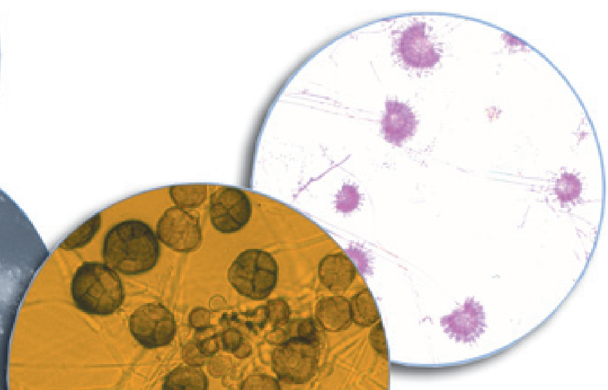
United States
Environmental Protection
Agency

EPA 402-K-01-001 | September 2008 | www.epa.gov/mold





Mold Remediation in Schools and Commercial Buildings



Indoor Air Quality (IAQ)

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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.

Cover Photos: Magnified photos of different species of mold

Mold Remediation in Schools and Commercial Buildings

Contents

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.

Investigating, Evaluating, and Remediating Moisture and Mold Problems

Safety Tips While Investigating and Evaluating Mold and Moisture Problems

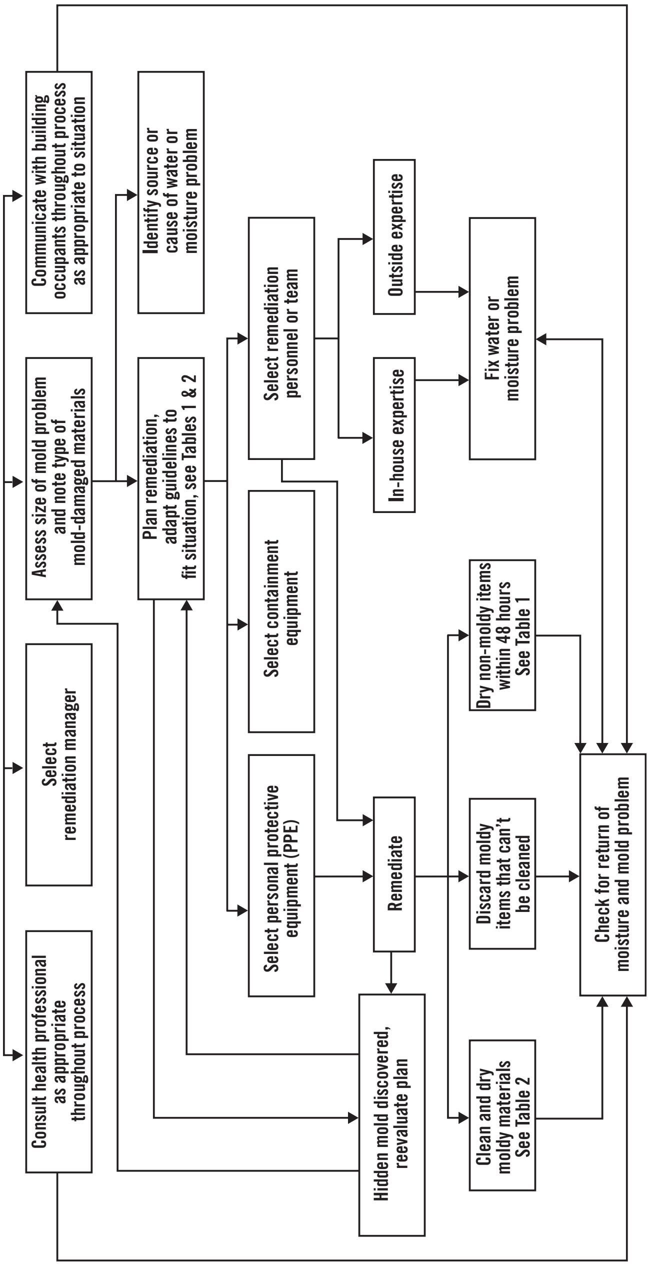
- Do not touch mold or moldy items with bare hands.
- Do not get mold or mold spores in your eyes.
- Do not breathe in mold or mold spores.
- Consult Table 2 and text for Personal Protective Equipment (PPE) and containment guidelines.
- Consider using PPE when disturbing mold. The minimum PPE is an N-95 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 wallboard looks fine, but the back side is covered with mold

Mold Remediation – Key Steps



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/cleanup 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 for 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

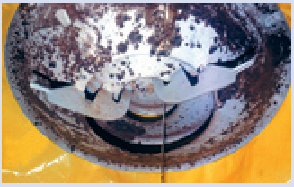


Photo 4B: Mold growth on air diffuser in ceiling

Photo 4C: Moldy air duct

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

Hidden Mold

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 drywall, 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 drywall 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.

Hidden Mold Growth

Photo 5: Mold growth behind wallpaper

[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 the Occupational Safety and Health Administration (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]

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 for off-hours when building occupants are less likely to be affected.

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.

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.

[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]

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,

Photo 6: Heavy mold growth on underside of spruce floorboards

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.

[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.

such as gypsum board. They 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 non-porous (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 ensure that the filter is properly seated in the vacuum so that all the air must pass through the filter. When changing the vacuum filter, 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)

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.

> Always use gloves and eye protection when cleaning up mold!

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 (OSHA) (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.

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.

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.

[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, wallboard, 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.

28 Mold Remediation in Schools and Commercial Buildings

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/biologic.html

Building Air Quality Action Plan (for Commercial Buildings)
www.epa.gov/iaq/largebldgs/pdf_files/baqactionplan.pdf

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

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

IAQ in Large Buildings / Commercial Buildings
www.epa.gov/iaq/largebldgs

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

Mold Remediation in Schools and Commercial Buildings
www.epa.gov/mold/mold_remediation.html

Mold Resources
www.epa.gov/mold/moldresources.html

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.acoem.org/
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)
(888) 347-AOEC (2632) 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

Asthma and Allergic Diseases:

American Academy of Allergy, Asthma & Immunology (AAAAI)
(414) 272-6071 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) LUNGUSA (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.nationaljewish.org/
Information on allergies and asthma

Canada Mortgage and Housing Corporation (CMHC)
(613) 748-2000 [International] www.cmhc-schl.gc.ca/
Several documents on mold-related topics available

Carpet and Rug Institute (CRI)
(706) 278-3176 www.carpet-rug.org/
Carpet maintenance, restoration guidelines for water-damaged carpet, other carpet-related issues

Centers for Disease Control and Prevention (CDC)
(800) CDC-INFO (232-4636) 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)
(800) CDC-INFO (232-4636) www.cdc.gov/mold/stachy.htm
Questions and answers on *Stachybotrys chartarum* and other molds

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) 621-FEMA (3362) www.fema.gov/hazard/flood/index.shtm
Publications on floods, flood proofing, etc.

University of Minnesota, Department of Environmental Health & Safety
(612) 626-6002 www.dehs.umn.edu/
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.phac-aspc.gc.ca/msds-ftss
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)
(916) 736-1100 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 Society of Cleaning Technicians (ISCT)
(800) WHY-ISCT (800-949-4728)
Information on cleaning such as stain removal guide for carpets

ISSA—The Worldwide Cleaning Industry Association
(800) 225-4772 www.issa.com
Education and training on cleaning and maintenance

National Air Duct Cleaners Association (NADCA)

(202) 737-2926 www.nadca.com
Duct cleaning information

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) CDC-INFO (232-4636) www.cdc.gov/niosh
Health and safety information with a workplace orientation

National Pesticide Information Center (NPIC)

(800) 858-7378 http://npic.orst.edu/
Regulatory information, safety information, and product information on antimicrobials

New York City Department of Health and Mental Hygiene

www.nyc.gov/html/doh/html/epi/moldrpt1.shtml
"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

Restoration Industry Association

(800) 272-7012 www.ascr.org/
Disaster recovery, water and fire damage, emergency tips, referrals to professionals

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 Museum Conservation Institute

(301) 238-1240 www.si.edu/mci
Guidelines for caring for and preserving furniture and wooden objects, paper-based materials; preservation studies

University of Michigan Herbarium

(734) 615-6200 www.herbarium.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

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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 whateverthey 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.

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.

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.

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.

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.

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 the Centers for Disease Control and Prevention (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 CDC for more information on pulmonary hemorrhage in infants (see Resources List, page 31, for CDC contact and other information).

* 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

This is a reprint of EPA document 402-K-01-001, March 2001. The guidance has not changed. The Resources List has been updated.

Indoor Air Quality (IAQ)

- U.S. Department of Labor
- Occupational Safety and Health Administration
- Directorate of Technical Support and Emergency Management
- (formerly Directorate of Science, Technology and Medicine)
- Office of Science and Technology Assessment

A Brief Guide to Mold in the Workplace

Safety and Health Information Bulletin

SHIB 03-10-10; updated 11-08-13

This Safety and Health Information Bulletin is **not** a standard or regulation, and it creates no new legal obligations. The Bulletin is advisory in nature, informational in content, and is intended to assist employers in providing a safe and healthful workplace. Pursuant to the *Occupational Safety and Health Act*, employers must comply with hazard-specific safety and health standards and regulations promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, pursuant to Section 5(a)(1), the General Duty Clause of the Act, employers must provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm.

Introduction

Concern about indoor exposure to mold has increased along with public awareness that exposure to mold can cause a variety of health effects and symptoms, including allergic reactions. This safety and health information bulletin provides recommendations for the prevention of mold growth and describes measures designed to protect the health of building occupants and workers involved in mold cleanup and prevention. This bulletin is directed primarily at building managers, custodians, and others responsible for building maintenance, but may also be used as a basic reference for those involved in mold remediation. By reading this safety and health information bulletin, individuals with little or no experience with mold remediation may be able to reasonably judge whether mold contamination can be managed in-house or whether outside assistance is required. The advice of a medical professional should always be sought if there are any emerging health issues. This document will help those responsible for building maintenance in the evaluation of remediation plans. Contractors and other professionals (e.g. industrial hygienists or other environmental health and safety professionals) who respond to mold and moisture situations in buildings, as well as members of the general public, also may find these guidelines helpful. The information in these guidelines is intended only as a summary of basic procedures and is not intended, nor should it be used, as a detailed guide to mold remediation. These guidelines are subject to change as more information regarding mold contamination and remediation becomes available.

Mold Basics

Molds are part of the natural environment. Molds are fungi that can be found anywhere - inside or outside - throughout the year. About 1,000 species of mold can be found in the United States, with more than 100,000 known species worldwide.

Outdoors, molds play an important role in nature by breaking down organic matter such as toppled trees, fallen leaves, and dead animals. We would not have food and medicines, like cheese and penicillin, without mold.

Indoors, mold growth should be avoided. Problems may arise when mold starts eating away at materials, affecting the look, smell, and possibly, with the respect to wood-framed buildings, affecting the structural integrity of the buildings.

Molds can grow on virtually any substance, as long as moisture or water, oxygen, and an organic source are present. Molds reproduce by creating tiny spores (viable seeds) that usually cannot be seen without magnification. Mold spores continually float through the indoor and outdoor air.

Molds are usually not a problem unless mold spores land on a damp spot and begin growing. 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.

When excessive moisture or water accumulates indoors, mold growth often will occur, particularly if the moisture problem remains uncorrected. While it is impossible to eliminate all molds and mold spores, controlling moisture can control indoor mold growth.

All molds share the characteristic of being able to grow without sunlight; mold needs only a viable seed (spore), a nutrient source, moisture, and the right temperature to proliferate. This explains why mold infestation is often found in damp, dark, hidden spaces; light and air circulation dry areas out, making them less hospitable for mold.

Molds gradually damage building materials and furnishings. If left unchecked, mold can eventually cause structural damage to a wood framed building, weakening floors and walls as it feeds on moist wooden structural members. If you suspect that mold has damaged building integrity, consult a structural engineer or other professional with the appropriate expertise.

Since mold requires water to grow, it is important to prevent excessive moisture in buildings. Some moisture problems in buildings have been linked to changes in building construction practices since the 1970s, which resulted in tightly sealed buildings with diminished ventilation, contributing to moisture vapor buildup. Other moisture problems may result from roof leaks, landscaping or gutters that direct water into or under a building, or unvented combustion appliance. Delayed or insufficient maintenance may contribute to moisture problems in buildings. Improper 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.

Health Effects

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. This section provides a brief overview, but does not describe all potential health effects related to mold exposure. For more detailed information, consult a health professional or your state or local health department.

There are many types of 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 (substances that can cause allergic reactions). Potential health concerns are important reasons to prevent mold growth and to remediate existing problem areas.

The onset of allergic reactions to mold can be either immediate or delayed. Allergic responses include hay fever-type symptoms such as runny nose and red eyes.

Molds may cause localized skin or mucosal infections but, in general, do not cause systemic infections in humans, except for persons with impaired immunity, AIDS, uncontrolled diabetes, or those taking immune suppressive drugs. An important reference with guidelines for immuno-compromised individuals can be found at the Centers for Disease Control and Prevention (CDC) website.

Molds can also cause asthma attacks in some individuals who are allergic to mold. In addition, exposure to mold can irritate the eyes, skin, nose and throat in certain individuals. Symptoms other than allergic and irritant types are not commonly reported as a result of inhaling mold in the indoor environment.

Some specific species of mold produce mycotoxins under certain environmental conditions. Potential health effects from mycotoxins are the subject of ongoing scientific research and are beyond the scope of this document.

Eating, drinking, and using tobacco products and cosmetics where mold remediation is taking place should be avoided. This will prevent unnecessary contamination of food, beverage, cosmetics, and tobacco products by mold and other harmful substances within the work area.

Prevention

Moisture control is the key to mold control. When water leaks or spills occur indoors - act promptly. Any initial water infiltration should be stopped and cleaned promptly. A prompt response (within 24-48 hours) and thorough clean- up, drying, and/or removal of water-damaged materials will prevent or limit mold growth.

Mold prevention tips include:

- Repairing plumbing leaks and leaks in the building structure as soon as possible.

- Looking for condensation and wet spots. Fix source(s) of moisture incursion problem(s) as soon as possible.
- Preventing moisture from condensing by increasing surface temperature or reducing the moisture level in the air (humidity). To increase surface temperature, insulate or increase air circulation. To reduce the moisture level in the air, repair leaks, increase ventilation (if outside air is cold and dry), or dehumidify (if outdoor air is warm and humid).
- Keeping HVAC drip pans clean, flowing properly, and unobstructed.
- Performing regularly scheduled building/ HVAC inspections and maintenance, including filter changes.
- Maintaining indoor relative humidity below 70% (25 - 60%, if possible).
- Venting moisture-generating appliances, such as dryers, to the outside where possible.
- Venting kitchens (cooking areas) and bathrooms according to local code requirements.
- Cleaning and drying wet or damp spots as soon as possible, but no more than 48 hours after discovery.
- Providing adequate drainage around buildings and sloping the ground away from building foundations. Follow all local building codes.
- Pinpointing areas where leaks have occurred, identifying the causes, and taking preventive action to ensure that they do not reoccur.

Questions That May Assist in Determining Whether a Mold Problem Currently Exists

- Are building materials or furnishings visibly moisture damaged?
- Have building materials been wet more than 48 hours?
- Are there existing moisture problems in the building?
- Are building occupants reporting musty or moldy odors?
- Are building occupants reporting health problems that they think are related to mold in the indoor environment?
- Has the building been recently remodeled or has the building use changed?
- Has routine maintenance been delayed or the maintenance plan been altered?

Always consider consulting a health professional to address any employee health concerns.

Remediation Plan

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.

Before planning the remediation assess the extent of the mold or moisture problem and the type of damaged materials. If you choose to hire outside assistance to do the cleanup, make sure the contractor has experience with mold remediation. Check references and ask the contractor to follow the recommendations in EPA's publication, "Mold Remediation in Schools and Commercial Buildings," or other guidelines developed by professional or governmental organizations.

The remediation plan should include steps to permanently correct the water or moisture problem. The plan should cover the use of appropriate personal protective equipment (PPE). It also should include steps to carefully contain and remove moldy building materials in a manner that will prevent further contamination. 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.

If you suspect that the HVAC system is contaminated with mold, or if mold is present near the intake to the system, contact the National Air Duct Cleaners Association (NADCA), or consult EPA's guide, "Should You Have the Air Ducts in Your Home Cleaned?" before taking further action. Do not run the HVAC system if you know or suspect that it is contaminated with mold, as it could spread contamination throughout the building. 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.

The remediation manager's highest priority must be to protect the health and safety of the building occupants and remediators. 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. In some cases, especially those involving large areas of contamination, the remediation plan may include temporary relocation of some or all of the building occupants.

When deciding if relocating occupants is necessary, consideration should be given to the size and type of mold growth, the type and extent of health effects reported by the occupants, the potential health risks that could be associated with the remediation activity, and the amount of disruption this activity is likely to cause. In addition, before deciding to relocate occupants, one should also evaluate the remediator's ability to contain/minimize possible aerosolization of mold spores given their expertise and the physical parameters of the workspace. When 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 physicians or other health-care professionals before working on mold remediation or investigating potentially moldy areas. If any individual has health concerns, doubts, or questions before beginning a remediation/cleanup project, he or she should consult a health professional.

Mold Remediation/Cleanup Methods

The purpose of mold remediation is to correct the moisture problem and to remove moldy and contaminated materials to prevent human exposure and further damage to building materials and furnishings. Porous materials that are wet and have mold growing on them may have to be discarded because molds can infiltrate porous substances and grow on or fill in empty spaces or crevices. This mold can be difficult or impossible to remove completely.

As a general rule, simply killing the mold, for example, with biocide is not enough. The mold must be removed, since the chemicals and proteins, which can cause a reaction in humans, are present even in dead mold.

A variety of 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. Some methods that may be used include the following:

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. Wet vacuums should be used only on wet materials, as spores may be exhausted into the indoor environment if insufficient liquid is present. The tanks, hoses, and attachments of these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may adhere to equipment surfaces.

Damp Wipe

Mold can generally be removed from nonporous surfaces by wiping or scrubbing with 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.

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 also are 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 passes through the filter. When changing the vacuum filter, remediators should wear respirators, appropriate personal protective clothing, gloves, and eye protection to prevent exposure to any captured mold and other contaminants. The filter and contents of the HEPA vacuum must be disposed of in impermeable bags or containers in such a way as to prevent release of the debris.

Disposal of Damaged Materials

Building materials and furnishings contaminated with mold growth that are not salvageable should be placed in sealed impermeable bags or closed containers while in the remediation area. These materials can usually be discarded as ordinary construction waste. It is important to package mold-contaminated materials in this fashion to minimize the dispersion of mold spores. Large items with heavy mold growth should be covered with polyethylene sheeting and sealed with duct tape before being removed from the remediation area. Some jobs may require the use of dust-tight chutes to move large quantities of debris to a dumpster strategically placed outside a window in the remediation area.

Use of Biocides

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 immuno-compromised individuals are present). In most cases, it is not possible or desirable to sterilize an area, as a background level of mold spores comparable to the level in outside air will persist. However, the spores in the ambient air will not cause further problems if the moisture level in the building has been corrected.

Biocides are toxic to animals and humans, as well as to mold. If you choose to use disinfectants or biocides, always ventilate the area, using outside air if possible, and exhaust the air to the outdoors. When using fans, take care not to extend the zone of contamination by distributing mold spores to a previously unaffected area. **Never mix chlorine bleach solution with other cleaning solutions or detergents that contain ammonia because this may produce highly toxic vapors and create a hazard to workers**.

Some biocides are considered pesticides, and some states require that only registered pesticide applicators apply these products in schools, commercial buildings, and homes. Make sure anyone applying a biocide is properly licensed where required.

Fungicides are commonly applied to outdoor plants, soil, and grains as a powder or spray. Examples of fungicides include hexachlorobenzene, organomercurials, pentachlorophenol, phthalimides, and dithiocarbamates.

Do not use fungicides developed for outdoor use in any indoor application, as they can be extremely toxic to animals and humans in an enclosed environment.

When you use biocides as a disinfectant or a pesticide, or as a fungicide, you should use appropriate PPE, including respirators. Always, read and follow product label precautions. It is a violation of Federal (EPA) law to use a biocide in any manner inconsistent with its label direction.

Mold Remediation Guidelines

This section presents remediation guidelines for building materials that have or are likely to have mold growth. The guidelines are designed to protect the health of cleanup personnel and other workers during remediation. These guidelines are based on the size of the area impacted by mold contamination. Please note that these are guidelines; some professionals may prefer other remediation methods, and certain circumstances may require different approaches or variations on the approaches described below. 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 or occupant exposure, professional judgment always should 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 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 should rely on 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.

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

- Remediation can be conducted by the regular building maintenance staff as long as they are trained 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).
- Respiratory protection (e.g., N-95 disposable respirator) is recommended. Respirators must be used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134). Gloves and eye protection should be worn.
- The work area should be unoccupied. Removing people from spaces adjacent to the work area is not necessary, but is recommended for 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).
- Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- Contaminated materials that cannot be cleaned should be removed from the building in a sealed impermeable plastic bag. These materials may be disposed of as ordinary waste.
- The work area and areas used by remediation workers for egress should be cleaned with a damp cloth or mop and a detergent solution.
- All areas should be left dry and visibly free from contamination and debris.

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

- Remediation can be conducted by the 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).
- Respiratory protection (e.g., N-95 disposable respirator) is recommended. Respirators must be used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134). Gloves and eye protection should be worn.
- The work area should be unoccupied. Removing people from spaces adjacent to the work area is not necessary, but is recommended for 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).
- Surfaces in the work area that could become contaminated should be covered with a secured plastic sheet(s) before remediation to contain dust/debris and prevent further contamination.

- Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- Contaminated materials that cannot be cleaned should be removed from the building in a sealed impermeable plastic bag. These materials may be disposed of as ordinary waste.
- The work area and areas used by remediation workers for egress should be HEPA vacuumed and cleaned with a damp cloth or mop and a detergent solution.
- All areas should be left dry and visibly free from contamination and debris.

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

Industrial hygienists or other environmental health and safety professionals with experience performing microbial investigations and/or mold remediation should be consulted prior to remediation activities to provide oversight for the project.

The following procedures may be implemented depending upon the severity of the contamination:

- It is recommended that personnel be trained in the handling of hazardous materials and equipped with respiratory protection (e.g., N-95 disposable respirator). Respirators must be used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134). Gloves and eye protection should be worn.
- Surfaces in the work area and areas directly adjacent that could become contaminated should be covered with a secured plastic sheet(s) before remediation to contain dust/ debris and prevent further contamination.
- Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
- The work area and areas directly adjacent should be unoccupied. Removing people from spaces near the work area is recommended for infants, persons having undergone recent surgery, immunosuppressed people, or people with chronic inflammatory lung diseases. (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- Dust suppression methods, such as misting (**not soaking**) surfaces prior to mediation, are recommended.
- Contaminated materials that cannot be cleaned should be removed from the building in sealed impermeable plastic bags. These materials may be disposed of as ordinary waste.
- The work area and surrounding areas should be HEPA vacuumed and cleaned with a damp cloth or mop and a detergent solution.
- All areas should be left dry and visibly free from contamination and debris.

Note: 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 mold is heavy (blanket coverage as opposed to patchy), it is recommended that the remediation procedures for Level IV be followed.

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

Industrial hygienists or other environmental health and safety professionals with experience performing microbial investigations and/or mold remediation should be consulted prior to remediation activities to provide oversight for the project.

The following procedures may be implemented depending upon the severity of the contamination:

- Personnel trained in the handling of hazardous materials and equipped with:
    - Full face piece respirators with HEPA cartridges;
    - Disposable protective clothing covering entire body including both head and shoes; and
    - Gloves.
- Containment of the affected area:
    - Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and other openings);
    - The use of an exhaust fan with a HEPA filter to generate negative pressurization; and
    - Airlocks and decontamination room.
- If contaminant practices effectively prevent mold from migrating from affected areas, it may not be necessary to remove people from surrounding work areas. However, removal is still recommended for infants, persons having undergone recent surgery, immune-suppressed people, or people with chronic inflammatory lung diseases. (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- Contaminated materials that cannot be cleaned should be removed from the building in sealed impermeable 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. These materials may be disposed of as ordinary waste.
- The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth or mopped with a detergent solution and be visibly clean prior to the removal of isolation barriers.

Personal Protective Equipment (PPE)

Any remediation work that disturbs mold and causes mold spores to become airborne increases the degree of respiratory exposure. Actions that tend to disperse mold include: breaking apart moldy porous materials such as wallboard; destructive invasive procedures to examine or remediate mold growth in a wall cavity; removal of contaminated wallpaper by stripping or peeling; using fans to dry items or ventilate areas.

The primary function of personal protective equipment is to prevent the inhalation and ingestion of mold and mold spores and to avoid mold contact with the skin or eyes. The following sections discuss the various types of PPE that may be used during remediation activities.

Skin and Eye Protection

Gloves protect the skin from contact with mold, as well as 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 substance/ chemical 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 piece respirator. Goggles must be designed to prevent the entry of dust and small particles. Safety glasses or goggles with open vent holes are not appropriate in mold remediation.

Respiratory Protection

Respirators protect cleanup workers from inhaling airborne mold, contaminated dust, and other particulates that are released during the remediation process. Either a half mask or full face piece air-purifying respirator can be used. A full face piece respirator provides both respiratory and eye protection. Please refer to the discussion of the different levels of remediation to ascertain the type of respiratory protection recommended. Respirators used to provide protection from mold and mold spores must be certified by the National Institute for Occupational Safety and Health (NIOSH). More protective respirators may have to be selected and used if toxic contaminants such as asbestos or lead are encountered during remediation.

As specified by OSHA in 29 CFR 1910.134 individuals who use respirators must be properly trained, have medical clearance, and be properly fit tested before they begin using a respirator. In addition, use of respirators requires the employer to develop and implement a written respiratory protection program, with worksite-specific procedures and elements.

Protective Clothing

While conducting building inspections and remediation work, individuals may encounter hazardous biological agents as well as chemical and physical hazards. Consequently, appropriate personal protective clothing (i.e., reusable or disposable) is recommended to minimize cross-contamination between work areas and clean areas, to prevent the transfer and spread of mold and other contaminants to street clothing, and to eliminate skin contact with mold and potential chemical exposures.

Disposable PPE should be discarded after it is used. They should be placed into impermeable bags, and usually can be discarded as ordinary construction waste. Appropriate precautions and protective equipment for biocide applicators should be selected based on the product manufacturer's warnings and recommendations (e.g., goggles or face shield, aprons or other protective clothing, gloves, and respiratory protection).

Sampling for Mold

Is it necessary to sample for mold? **In most cases, if visible mold growth is present, sampling is unnecessary**. Air sampling for mold may not be part of a routine assessment because decisions about appropriate remediation strategies often can be made on the basis of a visual inspection.

Your first step should be to inspect for any evidence of water damage and visible mold growth. Testing for mold is expensive, and there should be a clear reason for doing so. In many cases, it is not economically practical or useful to test for mold growth on surfaces or for airborne spores in the building. In addition, there are no standards for "acceptable" levels of mold in buildings, and the lack of a definitive correlation between exposure levels and health effects makes interpreting the data difficult, if not impossible.

Testing is usually done to compare the levels and types of mold spores found inside the building with those found outside of the building or for comparison with another location in the building. In addition, air sampling may provide tangible evidence supporting a hypothesis that investigators have formulated. For example, air sampling may show a higher concentration of the same species of mold when the HVAC is operating than when it has been turned off. This finding may convince the investigators that the mold is growing within, and being disseminated by, the HVAC system. Conversely, negative results may persuade investigators to abandon this hypothesis and to consider other sources of mold growth or dissemination. If you know you have a mold problem, it is more important to spend time and resources removing the mold and solving the moisture problem that causes the moldy conditions than to undertake extensive testing for the type and quantity of mold.

If you are in doubt about sampling, consult an industrial hygienist or other environmental health or safety professional with experience in microbial investigations to help you decide if sampling for mold is necessary or useful, and to identify persons who can conduct any necessary sampling. Due to the wide difference in individual susceptibility to mold contamination, sampling results sampling may have limited application. However, sampling results can be used as a guide to determine the extent of an infestation and the effectiveness of the cleanup. Their interpretation is best left to the industrial hygienist or other environmental health or safety professional.

Sampling for mold should be conducted by professionals with specific experience in designing mold-sampling protocols, sampling methods for microbial contaminants, and interpretation of results. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control." In addition, sampling and analysis should follow any other methods recommended by either OSHA, NIOSH, EPA, the American Industrial Hygiene Association, or other recognized professional guidelines. Types of samples can include: air samples, surface samples, bulk samples, and water samples from condensate drain pans or cooling towers.

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 other air samples is necessary. The

American Industrial Hygiene Association 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)).

Remediation Equipment

There are various types of equipment useful in mold assessment and remediation. Some of the more common items include:

Moisture Meters

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

Humidity Gauges or Meters

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

Humidistat

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

Boroscope

A boroscope is a hand-held tool that allows users to see potential mold problems inside walls, ceiling plenums, crawl spaces, and other tight areas. It consists of a video camera on the end of a flexible "snake." No major drilling or cutting of dry wall is required.

HVAC System Filter

High-quality filters must be used in a HVAC system during remediation because conventional HVAC filters are typically not effective in filtering particles the size of mold spores. Consult an engineer for the appropriate filter efficiency for your specific HVAC system, and consider upgrading your filters if necessary. 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, may be appropriate.

Remember to change filters as appropriate, especially following any remediation activities. Remove filters in a manner that minimizes the reentry of mold and other toxic substances into the workplace. Under certain circumstances, it may be necessary to wear appropriate PPE while performing this task.

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

- You must have identified and completely corrected the source of the water or moisture problem.
- Mold removal should be complete. Visible mold, mold-damaged materials, and moldy odors should no longer be present.
- Sampling, if conducted, should show that the level and types of mold and mold spores inside the building are similar to those found outside.
- You should revisit the site(s) after remediation, and it should show no signs of moldy or musty odors, water damage, or mold growth.

Conclusion

After correcting water or moisture infiltration, 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 rectified or the mold growth will reoccur. Emphasis should be placed on preventing contamination through proper building and HVAC system maintenance and prompt repair of water damaged areas.

Effective communication with building occupants is an essential component of all large-scale remediation efforts. The building owner, management, and/or employer should notify occupants 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. 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 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.

References

American Conference of Governmental Industrial Hygienists . 1999. *Bioaerosols Assessment and Control*

National Apartment Association

National Institute for Occupational Safety and Health (NIOSH)

National Multi-Housing Council

The Building Owners and Managers Association International (BOMA)

New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology (PDF) 2002. *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*

United States Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division 2001. Mold Remediation in Schools and Commercial Buildings. EPA 402-K-01-001

Mold Resources List

Business owners who are concerned about the cost of professional help can contact the OSHA Consultation Project Office in their state for free consultation service. Priority is given to businesses with fewer than 250 employees at a worksite, with further consideration given to the severity of the worksite problem. The Consultation Program can help the employer evaluate and prevent hazardous conditions in the workplace that can cause injuries and illnesses, including mold problems.

The following list of resources includes information developed and maintained by public and private organizations. However, OSHA does not control this information and cannot guarantee the accuracy, relevance, timeliness, or completeness of this outside information. Further, the inclusion of these 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 identified by the reference.

An Office Building Occupants Guide to Indoor Air Quality [Page title updated in 2012]

Biological Pollutants [Page title updated in 2012]

Building Air Quality (BAQ) [Page title updated in 2012]

Flood Cleanup to Protect Indoor Air Quality [Page title and link updated in 2015]

Indoor Air Quality (IAQ) Home Page

Indoor Air Quality in Offices and Other Large Buildings [Page title and link updated in 2015]

Creating Healthy Indoor Air Quality in Schools [Page title updated in 2015]

Resources for Flood Cleanup and Mold

Mold Remediation in Schools and Commercial Buildings Guide [Link updated in 2015]

- U.S. EPA IAQ Information Clearinghouse (IAQINFO)
- Phone: (800) 438-4318 or (703) 356-4020
- Fax: (703) 356-5386
- 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.

- *Air Conditioning Contractors of America (ACCA)*
- (703) 575-4477
- http://www.acca.org
- Information on indoor comfort products and services.

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

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

- American Industrial Hygiene Association (AIHA)
- (703) 849-8888
- 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
- Information on engineering issues and indoor air quality.

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

- *Association of Specialists in Cleaning and Restoration (ASCR)*
- (800) 272-7012 or (410) 729-3603
- www.ascr.org/institutes [http://www.restorationindustry.org]
- Carpet and Upholstery Cleaning Institute, Mechanical Systems Hygiene Institute, National Institute of Disaster Restoration, National Institute Rug Cleaning, Water Loss Institute referrals to professionals.

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

- Asthma and Allergy Foundation of American (AAFA)
- (800) 7ASTHMA ((800) 727-8462)

- Information on allergies and asthma.

- American Lung Association (ALA)
- (800) LUNGUSA ((800) 586-4872)
- Information on allergies and asthma.

- *Allergy and Asthma Network Mothers of Asthmatics (AANMA)*
- (800) 878-4403 or (703) 641-9595)
- Information on allergies and asthma.

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

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

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

- Centers for Disease Control and Prevention (CDC)
- (800) 311-3435
- Information on health-related topics including asthma molds in the environment, and occupational health. CDC is recognized as the lead federal agency for protecting the health and safety of the American people at home and abroad. It serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities.

- Flood Cleanup to Protect Indoor Air Quality [Page title and link updated in 2015]
- Federal Emergency Management Agency (FEMA)
- (800) 480-2520
- Publications on floods, flood proofing, etc.

- University of Minnesota, Department of Environmental Health and Safety
- (612) 626-5804
- Managing water infiltration into buildings

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

- Institute of Inspection, Cleaning and Restoration Certification (IICRC)
- (360) 693-5675

- Information on and standards for the inspection, cleaning, and restoration industry.

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

- *MidAtlantic Environmental Hygiene Resource Center (MEHRC)*
- (215) 387-4096
- Indoor environmental quality training center giving courses in building moisture and biocontamination, and managing and operating facilities for good IAQ. Extensive courses given in IAQ.

- *National Air Duct Cleaners Association (NADCA)*
- (202) 737-2926
- Duct cleaning information.

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

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

- National Pesticide Information Center (NPIC)
- (800) 858-7378
- Information on pesticides/antimicrobial chemicals, including safety and disposal information.

- New York City Department of Health, Bureau of Environmental and Occupational Disease Epidemiology, *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*
- (212) 788-4290

- Occupational Safety and Health Administration (OSHA)
- (800) 321-OSHA ((800) 321-6742)
- Information on worker safety and health, compliance assistance, laws and regulations, cooperative programs, state programs, statistics, and newsroom.

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

ASHRAE Position Document on Limiting Indoor Mold and Dampness in Buildings

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ABSTRACT

Credible research and cognizant health authorities have established an association between health problems and indoor dampness. A building's mechanical systems, its exterior enclosure, and its occupant activities all affect the amount of wetting and drying indoors. Therefore, ASHRAE takes the position that all policymakers, regulatory authorities, building professionals, and building occupants should be aware that indoor dampness, mold, and microbial growth are warnings of potential problems. All concerned should make decisions and take actions that help buildings, their contents, and their systems stay as dry as possible, given their functions. This position document provides help in understanding some of the complex interactions and decisions that lead to indoor dampness. However, professionals and the public need to know, with greater certainty than at present, when a building is "dry enough" to avoid dampness-related health risks. ASHRAE recommends further health-related building research to develop and publish a practical, quantitative, and effective definition and measurement technique for whole-building dampness.

HISTORY OF REVISION/REAFFIRMATION/WITHDRAWAL DATES

The following summarizes the revision, reaffirmation, or withdrawal dates:

2/6/2005—BOD approves Position Document titled *Minimizing Indoor Mold Problems through Management of Moisture in Building Systems*

10/22/2010—BOD approves revised Position Document titled *Limiting Indoor Mold Growth and Managing Moisture in Building Systems*

6/27/2012—BOD approves revised Position Document titled *Limiting Indoor Mold and Dampness in Buildings*

1/29/2013—Technology Council approves reaffirmation (with minor editorial updates) of Position Document titled *Limiting Indoor Mold and Dampness in Buildings*

Note: ASHRAE's Technology Council and the cognizant committee recommend revision, reaffirmation, or withdrawal every 30 months.

Note: ASHRAE position documents are approved by the Board of Directors and express the views of the Society on a specific issue. The purpose of these documents is to provide objective, authoritative background information to persons interested in issues within ASHRAE's expertise, particularly in areas where such information will be helpful in drafting sound public policy. A related purpose is also to serve as an educational tool clarifying ASHRAE's position for its members and professionals, in general, advancing the arts and sciences of HVAC&R.

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EXECUTIVE SUMMARY

In many parts of the world, moisture damage and microbial growth including mold have caused billions of dollars in repair costs and interruption of building operations. Further, in both North America and Europe, building dampness and mold have been documented to be associated with adverse health outcomes related to asthma and upper respiratory problems.

As moisture levels increase, so does the possibility of microbial growth and with it the potential for adverse effects on the building and its occupants. The buildup of moisture indoors can be controlled through the building's design, construction, and operation and the actions of its occupants.

ASHRAE is a cognizant technical authority in the field of HVAC system design, installation, and operation, as well as building energy conservation. All of these factors can influence the amount of moisture in buildings. Consequently, those who develop and enforce public policy within the building industry often rely upon ASHRAE standards and guidance. Therefore, it is appropriate for ASHRAE to make clear the Society's positions with respect to managing moisture, avoiding persistent dampness, and reducing the risks associated with indoor microbial growth.

ASHRAE currently takes the following positions:

1. When humidity and moisture are not effectively controlled, persistent dampness can lead to material damage, corrosion, structural decay, and microbial growth, including mold. Cognizant health authorities have established an association between damp buildings and the increased potential for adverse health effects (IOM 2004, WHO 2009, New York State 2010, Mudarri and Fisk 2007, Fisk et al. 2007, Mendell 2011). ASHRAE believes that the potential for these problems can and should be reduced by limiting the buildup of indoor moisture through the decisions and actions taken by designers, contractors, owners, and occupants of buildings.
2. Small amounts of wetting and drying in buildings and in HVAC systems are normal and represent no long-term risk for durability, increased energy consumption, or mold growth. Occasional wetting is not usually a problem provided that wetting is followed promptly by drying. Problems occur when the dampness becomes persistent. To limit the potential for problems, professionals and the general public should be aware there are risks associated with prolonged dampness and should take action to prevent and correct such conditions.
3. Currently, no quantitative, health-based exposure guideline or thresholds can be recommended for acceptable levels of contamination by microorganisms (IOM 2004). While associations between persistent dampness and adverse health effects have been observed, relationships between persistent dampness, microbial exposure, and health effects cannot be quantified precisely at this time (WHO 2009, Mendell 2011). In light of this information, ASHRAE believes the most effective course is to limit the potential for microbial growth indoors by reducing the causes of persistent dampness.

1. ISSUES

The six issues addressed by this position document are summarized below. The inherent complexities of these issues are described in more depth in the appendix.

1.1 Health

Negative health effects have been credibly established as being associated with dampness in buildings. But to date the exact causes and the exact extent of such problems has not been defined. As an engineering society rather than a cognizant health authority, ASHRAE expects and follows guidance from health professionals with respect to the health effects of indoor dampness, mold, and microbial growth.

1.2 Damp Building Definition and the Need for Its Improvement

According to public health researchers, problems in the past have been associated with the occurrence of visible water damage or stains, visible mold, and/or odors from microbial growth (WHO 2009; Mendell et al. 2011). The presence of these factors—alone or in combination—is therefore useful as a warning and as a call for action to remediate the source of the water accumulation. However, the presence of these three factors, even in combination, allows neither certainty nor practical quantification concerning health-relevant dampness.

Consequently, ASHRAE recommends further health-related building research. The goal should be to develop and publish a quantitative definition of a “damp building,” together with an economically practical measurement technique. To be useful in the real world of building design, construction and operation, such a definition and measurement technique must allow determination (with reasonable and repeatable certainty) of a building that is “dry enough” to avoid dampness-related health risks.

1.3 Negative Effects of Moisture Other than Microbial Growth

Quite apart from health effects, there are other important reasons to avoid excessive indoor moisture accumulation. The appendix to this position document outlines some of the non-health-related negative effects of moisture on buildings.

1.4 Complex Causation

Based on past observation of problem buildings, dampness sufficient to cause problems seldom has a single cause. More often, a series of events, including decisions in many areas of professional and personal responsibility, combine in complex ways to cause a problem. Therefore, it is not appropriate to assign responsibility for building dryness to any one group, because it is not likely that any one group can prevent a problematic level of dampness, mold, and microbial growth by their actions alone.

1.5 Decisions and Actions that Avoid Problems

There are known and avoidable contributors to moisture, mold, and microbial growth problems in all areas of professional and personal responsibility (HVAC, architectural design and construction, building operation and maintenance, building occupant's actions, and the actions of policymakers and regulatory authorities). The appendix provides useful detail about decisions and actions that have increased or reduced risks.

1.6 Investigation and Remediation of Mold and Microbial Growth Problems

ASHRAE provides neither guidance nor professional certification in this area but notes that other cognizant authorities have established useful guidelines for mold investigations and remediation. Some cautions for investigators and building owners about investigations are included in the appendix to this document.

2. BACKGROUND

Well-designed, well-constructed, well-maintained building envelopes are critical to the prevention and control of excess moisture and microbial growth, because they limit thermal bridges and the entry of liquid water, humid air, or water vapor diffusion. Management of moisture also requires control of temperature and ventilation to avoid excess humidity, condensation on surfaces, or excess moisture in materials.

Building owners are responsible for providing a healthy workplace or living environment without excess moisture and mold by ensuring proper building design, construction, and maintenance. To the extent that they are allowed control, building occupants are responsible for managing the use of water, heating, air conditioning, ventilation, and appliances in a manner that does not contribute to dampness and mold growth.

To help reduce the potential for problems, ASHRAE provides the observations, suggestions, and resources described in the appendix to this position document and makes the following recommendations.

3. RECOMMENDATIONS

a. All building professionals, building occupants, public policymakers, and regulators should understand that persistent indoor dampness is neither normal nor desirable and can lead to problems for both the occupants and the building itself. All concerned should take action to design, construct, and keep buildings and their systems as dry as possible, given their normal functions.

b. To more effectively inform the professions and the public, ASHRAE technical committees should generate a new chapter for the ASHRAE Handbook consolidating known problems and describing known techniques for managing and measuring moisture in buildings and for avoiding problems associated with indoor dampness. In addition, ASHRAE technical committees should strengthen guidance provided in other chapters of the ASHRAE Handbook with respect to minimizing the risk of excessive moisture accumulation in buildings and HVAC systems.

c. ASHRAE should establish a joint research project in cooperation with cognizant health authorities, related professional societies, and building owners to develop and publish a practical, quantitative, and certain definition and inspection protocol for whole-building dampness. Both the professions and the public need to know when a building is "dry enough" to reduce dampness-related health risks.

d. ASHRAE should remain committed to continue updating the more than 3000 pages of ASHRAE resources described in the reference sections of this document on a regular basis, through volunteer and partner-supported efforts.

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APPENDIX

COMMITTEE OBSERVATIONS CONCERNING MOLD AND MOISTURE PROBLEMSIN BUILDINGS

HEALTH

ASHRAE's expertise lies in the areas of design, installation, operation, and maintenance of mechanical systems and in the hygrothermal performance of building enclosures. These systems do not guarantee human health, which is a result of complex interactions between building systems; outdoor air change rates; air contaminant concentrations; emissions of air contaminants from building materials, furnishings, and equipment; as well as occupant activities and individual susceptibilities. Consequently, for all opinions related to the health impacts of exposure to microbial contaminants (including mold), ASHRAE relies on the expertise of the medical community. ASHRAE's review and analyses of the literature has led to the following observations:

a. When buildings get wet or damp and stay damp for a long enough period of time, microbial growth on building materials and furnishings can occur, including growth of molds, other fungi, and bacteria. This microbial growth can result in significant increases of indoor concentrations of airborne microbial contaminants, including mold spores and mycelia fragments, bacterial spores and cell fragments, mycotoxins, and microbial volatile organic compounds (Park et al. 2008, Cox-Ganser et al. 2005).
b. The medical community has long recognized that in agricultural occupational settings, worker exposures to very high concentrations of microbial air contaminants, including mold spores and bacteria, can cause adverse health effects, including asthma, bronchitis, rhinitis, mucous membrane irritation, allergic alveolitis (hypersensitivity pneumonitis), and inhalation fever (Hodgson and Flannigan 2001, Sorenson 2001).
c. The medical community has also long recognized that in health care settings, especially in immuno-compromised patients, exposure to even relatively low levels of pathogenic fungi such as *Aspergillus fumigatus* can cause severe invasive respiratory disease and death. In these settings, the buildings' HVAC systems must be carefully designed, installed, and operated to significantly reduce exposure (ASHRAE 2008).
d. The precise nature of health effects in buildings with moisture problems and their relationships to types and levels of microbial air and surface contaminants, including mold spores, is not fully understood. However, in the U.S., the Institute of Medicine (2004) concluded in *Damp Indoor Spaces and Health* that while there was not at that time sufficient evidence of a causal relationship between health outcomes and exposure to mold or other agents in damp buildings, there was sufficient evidence of an association between damp buildings and upper respiratory tract symptoms, asthma symptoms in sensitized asthmatic persons, hypersensitivity pneumonitis in susceptible persons, wheezing, and coughing. In the years since that report, other credible sources have reached similar conclusions (WHO 2009, New York State 2010, Mendell et al. 2011).
e. According to public health researchers, problems in the past have been associated with the occurrence of any of three factors: visible water damage or stains, visible mold, and odors from microbial growth (WHO 2009; Mendell et al. 2011). The absence of any of these three factors does not rule out the potential for a problem, nor does their presence

indicate the certainty of one. But when any of these three factors are present, the research suggests that building owners and occupants should be aware of the potential for health-related problems and take steps to investigate and eliminate the causes of excessive moisture accumulation.

The implication of these observations by cognizant health authorities and public health researchers is that the prudent course for owners, designers, builders, installers, and operators of all buildings and HVAC systems is to make decisions and take actions that limit the potential for long-term accumulation of excess moisture in building materials and systems.

DAMP BUILDING DEFINITION AND THE NEED FOR ITS IMPROVEMENT

For many years, public health researchers have observed that health problems are more common in "damp buildings" (IOM 2004, WHO 2005, Cox-Ganser 2005, etc.).

Further, for decades the mechanisms of mold growth in buildings have been clear, and computerized mold growth models have been well correlated with laboratory experimental results (ASHRAE 2009a, Viitanen 1997, Rowan et al. 1999, Pasenen et al. 2000, and Sedlbauer et al. 2001). Recently, public health researchers (WHO 2009; Mendell et al. 2011) have noted that negative health effects among occupants have been more commonly reported when a building exhibits evidence of excessive moisture, such as:

- Visual evidence of water damage or water stains
- Visible mold growth
- Moldy or earthy odors

While these research results are helpful, they are not sufficient. They provide no actionable definition of a "damp building." And they provide no quantitative definition of how many water stains, how much visible mold growth, or what strength of musty odors are sufficient to suggest that action is required to avoid negative health effects. Many buildings have one or more of these problems, in small amounts, in different parts of the building, without any recognized negative health effects. It is only by aggregating many buildings that health studies have documented the consistent, significant associations of these problems with respiratory and allergic effects. However, the studies have not identified threshold amounts of one or more of these problems that merit action.

To be useful for those who intend to prevent problems in buildings and investigate them when they do occur, a definition of a damp building likely to produce negative health effects needs to include:

a. Discreet threshold levels of concern for the moisture content of building materials that have been frequently observed to be either sensitive to mold growth and/or that serve as reservoirs of moisture that transfers to nearby sensitive materials.
b. A material moisture content measurement technology, sampling procedure, and inspection methodology that is sufficient (in the real world of large buildings and complex building assemblies) to repeatably and economically identify at least three levels of health concern for the general population: low, medium, and high probability of negative health effects among a randomly-selected population.
c. Health concern adjustment factors for important segments of the general population that are known to have elevated sensitivity to health effects of damp buildings including (at

least) infants and the elderly, asthmatics, and individuals with compromised immune systems.

d. An empirical foundation for the definition and protocol that includes a correlation of the protocol results with observed negative health effects in real-world buildings and real-world populations.
e. Documented tests using a random selection of building owners and building investigators that demonstrate that the protocol is relevant, repeatable, and economical enough for general use.

ASHRAE does not have the expertise to lead such a research effort, but our technical and standing committees can and must be a part of the research to help ensure that the resulting protocol is relevant, repeatable, and economical enough for everyday use by both building investigators and building owners.

NEGATIVE EFFECTS OF MOISTURE OTHER THAN MICROBIAL GROWTH

Long-term moisture accumulation has documented negative consequences quite apart from mold growth or any potential health risks of damp buildings. Measurable effects of excess moisture accumulation and/or episodic water damage include the following:

a. Shortening the life of materials, structural fasteners, and building assemblies, which increases structural risk and leads to excess maintenance, repair, and renovation costs (Harriman et al. 2006).
b. Reducing the effectiveness of insulation, leading to increased energy consumption.
c. Reducing the perceived value of a property and increasing the cost of its insurance coverage.
d. Reducing occupant satisfaction because of unpleasant odors and musty smells.

Based on these observations, ASHRAE believes that the prudent course for designers, installers, builders, owners, operators, and occupants of buildings and building systems is to make decisions and take actions that limit the potential for long-term accumulation of excess indoor moisture. Keeping buildings dry reduces the risk of problems with respect to their value, durability, sustainability, indoor air quality, occupant comfort, and energy efficiency.

COMPLEX CAUSATION

Mold spores and mycelial fragments can be found in the air and on surfaces of nearly all buildings, but prolific mold growth is not. Airborne mold contaminants, including mold spores and hyphal fragments, are constantly present in outdoor air in concentrations that vary widely by season, location, and even time of day. In all buildings, airborne mold contaminants in outdoor air enter the building through the ventilation system, through open windows, and through air leaks in the building envelope. In clean, dry buildings, the indoor concentration of airborne mold contaminants is typically less than the outdoor concentration. In contrast, in buildings that become damp enough to support mold growth, the indoor concentrations of airborne mold contaminants can become much higher than the outdoor concentrations. In addition to differing concentrations, the types of microbial contaminants in buildings that become damp may be different from those typically present outdoors and in dry buildings.

ASHRAE observes that microbial growth, including mold and bacteria, does not occur without an accumulation of excessive amounts of moisture for a sufficient amount of time, within an adequate temperature range and in a material or surface coating that is microbially digestible (ASHRAE 2009a).

Factors that allow all of these preconditions to persist for long enough to create a microbial growth problem are highly complex. Surface treatments, moisture content, duration of excessive moisture, and material temperature can vary widely over a distance of a few inches or centimeters, leading to microbial growth in one small portion of a given material and the absence of microbial growth in nearby parts of the same material (Harriman and Lstiburek 2009).

Also, a material that is not microbially digestible, such as concrete or masonry, may act as a reservoir for excess moisture. That moisture can then transfer over time to more digestible materials nearby, such as paint layers or untreated paper-faced gypsum board. In addition, dust, dirt, and oils commonly accumulate on materials, creating an organic layer that can support microbial growth if the near-surface air layer is sufficiently humid for long periods. For example, the residual soap film on floors, bathtubs, and showers is an organic layer that can support microbial growth when it is damp, even though the ceramic tile surface itself does not support mold growth.

Further, the interactions that lead to the necessary amount and duration of moisture accumulation are similarly complex. One example of the interactions between different building elements that combine to result in moisture accumulation includes vinyl wallpaper on the indoor surfaces of exterior walls in combination with an air-conditioned space in a hot, humid climate. Outdoor air with a high dew point infiltrates the wall and condenses on the cavity side of the cool interior gypsum wallboard. Because the vinyl wallpaper is relatively impervious to water vapor transport, moisture accumulates in the wall cavity, resulting in microbial growth, including mold, and eventually decay and rot.

Note that the growth in this situation requires high outdoor dew point for many days or weeks, extensive air leakage through the enclosure, chilled indoor surfaces, vinyl wallpaper, and untreated paper-faced gypsum board. If any one of those elements is absent, it is quite possible that little or no mold growth would occur (Harriman et al. 2006). This example includes the following elements:

a. The owner or interior designer made a decision to install vinyl wall covering rather than a more permeable wall covering.
b. The architectural designer apparently designed and/or the contractor built a building that allows extensive inward humid air infiltration and also selected untreated gypsum wallboard for a location likely to experience high humidity in a climate where that high humidity will continue for many months.
c. The HVAC system is apparently designed and/or installed such that it overcools wall surfaces, and it is designed and installed (or operated) such that it encourages humid air infiltration and a high surface relative humidity (RH) inside the wall for extended periods.

As the example illustrates, risks from not one but several decisions made by many different professionals can act in combination to produce enough moisture accumulation in the wall cavities for a long enough period to create a microbial growth problem. Rarely can one profession, acting in isolation, take all the actions that either produce or prevent a moisture problem. Preventing moisture problems requires attention from the owner as well as all of the building professions.

Further, the risk of excess moisture accumulation can be either increased or reduced by the building occupants themselves as they use the building for their daily activities. For instance, if the occupants of an apartment generate a significant amount of moisture from cooking and cleaning activities without opening windows or using exhaust fans, excess moisture accumulation and mold growth may occur. A building is a complex and dynamic system, and its occupants are an integral and constantly changing component of that system.

Finally, individuals in the same building may be quite different with respect to their particular sensitivities to airborne microbial contaminants. A low level of contamination that causes adverse health effects for one sensitive individual often causes no health effects for others. Because of the complexity of these interactions, from a public policy perspective it would be ineffective and inappropriate to assign sole responsibility for microbial growth avoidance to any single group.

The prudent course of action is to keep all of the materials that make up a building and its HVAC systems as dry as possible, consistent with their normal functions. More specifics are discussed in Section A5. In general terms, all building professionals and occupants should be advised to do the following:

a. Remain aware that the factors that lead to microbial contamination, including mold, are catastrophic water damage, repeated wetting, or excessive long-term moisture accumulation in materials.
b. Make decisions and take actions that will keep the building and its systems, furnishings, and finishes as dry as possible, given the function of the component in question and the available resources.
c. Be aware that, if adequate resources are not made available to keep the building, its systems, and contents dry, then the risk of microbial contamination, including mold, will increase.
d. Keep the above facts in mind whenever one observes persistent dampness inside a building or when one constantly observes stagnant water in condensate drain pans or constantly damp insulation, filters, or sound lining of HVAC systems.

KNOWN FACTORS THAT INCREASE OR REDUCE THE RISK OF MOLD AND MOISTURE PROBLEMS

In each area of professional and occupant activity, there are decisions and actions that can either increase or reduce the risk of problems related to moisture, mold, and other microbial growth. In most cases, the individuals involved are not aware they are making fateful decisions. The factors described below come from the broad array of building professionals' experiences, many of which have been collected in ASHRAE publications and in the publications of allied professional societies.

When reviewing these factors, it is important to keep in mind that moisture and mold problems can develop for different reasons in cold and hot climates and can also occur through mechanisms caused by regionally specific building designs, material selections, and construction practices in different parts of the world. Therefore, recommendations based on local conditions are often needed to avoid dampness-related problems.

Note also that these factors have seldom been responsible, in isolation, for moisture and microbial growth problems. More commonly, the risk of microbial growth has increased when more than one of these factors are present or when an architectural risk factor is combined with risk factors associated with either HVAC systems or occupant activities.

a. HVAC factors that have been observed to ***reduce*** the risks of moisture accumulation, mold, and microbial growth include the following:
   1. Ensuring that all ventilation air is dried to a dew point below the dew point maintained inside the building when the building is being mechanically cooled (Harriman and Lstiburek 2009, Harriman et al. 2006).
   2. Ensuring that all condensation inside HVAC components and air distribution ductwork is drained to an appropriate sanitary drain or condensate collection system (Harriman et al. 2006).
   3. Ensuring that indoor surfaces of both occupied and unoccupied spaces are not cooled to temperatures so low as to create an average surface RH of over 80% that lasts for more than 30 days or surfaces cold enough to allow visible condensation (ASHRAE 2009a).

      Note that the relative humidity of air measured in the occupied space or return air does not indicate the RH in the thin boundary layer of air in contact with cool surfaces. Monitoring and controlling indoor dew point compared to indoor surface temperatures is the more useful metric for humidity control decisions.

      For example, in buildings that are being mechanically cooled during hot or humid weather, keeping the indoor air dew point below 55°F (12.8°C) nearly always ensures that surface RH will stay below 80% even on cool surfaces. In contrast, if the indoor air RH is 55% at 78°F (25.6°C), any surface cooled below 66°F (18.9°C) will have an RH above 80% (Harriman and Lstiburek 2009).
   4. Keeping the indoor dew point low enough to ensure that there is no condensation on the exposed surfaces of cool HVAC components or on sensitive building materials or furnishings. Nor should the indoor dew point be high enough to allow any surface RH over 80% when averaged over 30 days. The caution against condensation and long-term average surface RH above 80% applies not only to visible surfaces in occupied spaces but also to surfaces inside hidden building cavities and unconditioned spaces (Harriman et al. 2006).
   5. Ensuring that humidifiers are sized, installed, and controlled so they do not overload the air with humidity, which increases the risk of condensation inside air distribution systems and exterior walls and roofing assemblies (Harriman et al. 2006).
   6. Ensuring that cold HVAC and plumbing components and systems such as chilled-water pipes and valves, supply air ducts, cold domestic water lines, and cold condensate drain piping are sufficiently insulated to keep the temperature of all of their surfaces at least 10°F (4°C) above the dew point of the surrounding air. Note that pipes often pass through unconditioned spaces such as basements, crawlspaces, and attics. Insulation must be continuous and complete to limit high surface RH on a cold pipe as it passes through such high-dew-point locations (Harriman and Lstiburek 2009).

b. HVAC factors that have been observed to ***increase*** the risks of moisture accumulation include:
   1. Failing to keep the indoor dew point low enough to prevent condensation indoors or failing to keep surface RH below 80% in occupied spaces or inside hidden building assemblies (Harriman and Lstiburek 2009).

2. Overchilling a building's surfaces during humid weather (Harriman and Lstiburek 2009).
3. Redistributing microbial air contaminants, including mold, from a contaminated space into occupied areas. Examples of contaminated spaces sometimes include parts of the building under construction or renovation, hidden building assemblies such as damp crawlspaces or attics, or spaces above dropped ceilings or below raised floors (Harriman and Lstiburek 2009).
4. Failing to make air distribution components and joints in return plenums and supply and exhaust ducts sufficiently airtight. Joints and connections must be tight enough to prevent suction that otherwise pulls humid outdoor air into the building and/or leakage that allows cold supply air to chill surfaces inside humid building cavities (Harriman and Lstiburek 2009, Harriman et al. 2006).
5. Failing to keep the long-term average indoor air pressure positive with respect to the outdoors when the outdoor dew point is higher than indoor surface temperatures (Harriman et al. 2006).
6. Failing to prevent dirt and dust accumulation on cooling coils and on duct surfaces and sound lining downstream of cooling coils. This can lead to microbial growth in the damp layer of dust that collects inside the cooling system. Installing access panels that allow for the inspection and cleaning of the condensate pans and areas upstream and downstream of cooling coils is an important requirement for ensuring the condensate pan is not ponding water, the coils are clean, and the upstream and downstream surfaces are clean and dry. Regular cleaning and ultraviolet lamps can reduce the impact of occasional lapses in filtration. But over time, effective filtration is the most important factor in preventing microbial growth in those parts of the system that can be expected to accumulate moisture during normal operation.
7. Failing to keep the air velocity through cooling coils low enough to prevent droplet carryover into downstream ductwork and filters, leading to microbial growth in those locations (Harriman and Lstiburek 2009).
8. Failing to install condensate drain traps deep enough to allow free-flowing drainage of normal cooling coil condensate and failing to install traps and condensate drain lines with a diameter large enough to allow maintenance personnel to both observe clogs and clean out anything that obstructs free-flowing drainage (Harriman et al. 2006).
9. Failing to install accessible cleanouts in condensate drain lines to allow periodic removal of algae and the particulate, feathers, sticks, and leaves that typically wash off the coil. Note that copper piping has been effective in limiting accumulation in condensate drain lines (Harriman et al. 2006).
10. Failing to measure and limit the volume of ventilation and makeup air to the amount required for the application and that will in fact be dried effectively by the system's dehumidification components (Harriman and Lstiburek 2009). (Note that ventilation without dehumidification has been responsible for major mold growth problems in hot and humid climates. Whenever any building in any climate is being mechanically ventilated, the indoor dew point must remain low enough to keep the indoor surface RH below 80%, even on hidden cool surfaces.)
11. Failing to ensure that system operation during unoccupied periods keeps the indoor dew point low enough to prevent a 30-day average surface RH above 80% on cool surfaces, 100% RH for 24 consecutive hours, or visible condensation. Mold and microbial

growth accelerates when the indoor dew point stays high while surfaces are intermittently chilled by cooling systems. Moisture accumulation caused by intermittent chilling of surfaces often occurs in unoccupied schools and health care clinics overnight or during vacations if dew points are uncontrolled when cooling systems are reset to higher indoor temperature setpoints (Harriman and Lstiburek 2009).

12. Failing to ensure that the temperatures of chilled-water systems stays low enough and the flow rates through the coils stay high enough to effectively dry the air (when such a chilled-water system is the only means of removing excess humidity from the building) (Harriman and Lstiburek 2009).

c. Architectural features that have been observed to ***reduce*** the risks of moisture accumulation and microbial growth include:
   1. Roof overhangs of at least 24 in. (600 mm) or more (CMHC 1996).
   2. Pan flashing under windows and doors that forces any water leakage outward onto an effective water barrier and then out of the building wall (Harriman and Lstiburek 2009, ASTM 2006, ASTM 2009, JLC 2007).
   3. Crawlspaces that are sufficiently lined and sealed to prevent infiltration into the building from surface water, moisture from the soil, and humid air (DOE 2005).

d. Architectural features that have been observed to ***increase*** the risks of moisture accumulation and microbial growth include:
   1. Vinyl wall covering on exterior and demising walls of buildings in hot and humid climates. Problems have frequently occurred behind vinyl wall covering when, as is quite common, the building lacks a continuous, sealed air barrier that effectively keeps humid outdoor air out of the cavities inside the exterior and demising walls (Harriman and Lstiburek 2009).
   2. Damp crawlspaces (DOE 2005).
   3. Water accumulating next to or under the building's foundation (Rose 2005, ASTM 2009).
   4. Rain leaks through joints around windows, doors, or other wall penetrations such as through-wall AC units, electrical fixtures, exhaust ducts, or structural fasteners or leakage through joints where different types of exterior cladding come together (Harriman and Lstiburek 2009).
   5. Absence of effective flashing around windows, doors, skylights, and other penetrations of the building's walls or roof (ASTM 2009).
   6. Absence of an effective, continuously sealed air barrier covering all six sides of the building envelope, allowing leakage of humid air from either indoors or outdoors into cool exterior walls, crawlspaces, roof assemblies, or attics (ASHRAE 2011a, ASHRAE 2010b).
   7. Absorptive exterior cladding such as brick veneer, stucco, or masonry that retains rain water but is not backed by a free-draining and vented air gap followed by an impermeable water and vapor barrier and flashing to exclude moisture (ASHRAE 2009b).
   8. Failing to install effective flashing around wall penetrations and terminations of external insulation and finish systems, along with a protective and continuously sealed waterproof drainage layer integrated with that flashing behind the insulation (Harriman and Lstiburek 2009).

e. Building operational decisions that have ***reduced*** the risks of moisture accumulation and microbial growth include:

1. Mopping and drying up spilled liquids or wash water promptly, limiting the amount of water that soaks into walls, carpeting, or flooring materials through the development of spill protocols and standard operating procedures.
2. Repairing plumbing leaks quickly and drying up any water leakage that resulted from the leaks within 24 to 48 hours.
3. Keeping irrigation spray heads aimed carefully, preventing the frequent soaking of exterior walls and foundation.
4. Maintaining the slope of exterior landscaping so that rainwater and irrigation spray flows away from the foundation rather than accumulating there.
5. Keeping rainwater runoff from the roof at least 3 ft away from the foundation.
6. Removing mold and other microbial contaminants promptly with appropriate engineering controls (e.g., HEPA air filtration, negative pressure containments) to keep contaminants from becoming airborne and distributed throughout the building, in accordance with procedures established by cognizant authorities (EPA 2001, AIHA 2008, ACGIH 1999, IICRC 2008).

f. Building operational decisions that have ***increased*** the risks of moisture accumulation have included:
   1. Failing to effectively exhaust humid air from showers, spas, decorative water fountains, indoor landscaping irrigation, and swimming pools. (When the weather is hot and humid, a related problem is the failure to dry the air that is brought into the building as makeup for exhausted air.)
   2. In cold weather, humidifying the indoor air to dew points high enough to create conditions where there are entire days or weeks of condensation or surface RH above 80% inside cooled walls and attics.
   3. Failing to ensure that the temperatures of chilled-water systems stay low enough and the flow rates through the coils stay high enough to effectively dry the air when such chilled-water systems are the only means of removing excess humidity from the building. (The problem often occurs when chilled-water temperatures are reset in an effort to save energy when the building is unoccupied during hot and humid weather. When chilled-water temperatures must be reset to save energy, or when flow rates through coils are too slow to dry the air, a separate dehumidification system may be necessary to prevent problems associated with persistent dampness.) (Harriman et al. 2006)

g. Home dwellers' decisions that have been observed to ***reduce*** the risks of moisture accumulation and microbial growth include:
   1. Keeping shower or tub splash within the tub enclosure, limiting the amount of water that can soak the floor or walls of the bathroom.
   2. Mopping and drying spilled liquids or wash water promptly, limiting the amount of water that soaks into walls, carpets, or flooring materials during cleaning operations, and drying the water that remains within 24 to 48 hours.
   3. Repairing plumbing leaks quickly and drying any water leakage that resulted from the leaks within 24 to 48 hours.
   4. Keeping irrigation spray heads aimed carefully, preventing the soaking of exterior walls and foundation.
   5. Maintaining the slope of the landscaping so that rainwater and irrigation runoff flows away from the foundation rather than accumulating there.
   6. Keeping rainwater runoff from the roof at least 3 ft away from the foundation.

7. Removing mold and other microbial contaminants promptly with appropriate engineering controls (e.g., HEPA air filtration, negative pressure containments) to keep contaminants from becoming airborne and distributed throughout the building, in accordance with procedures established by cognizant authorities (EPA 2001, AIHA 2008, ACGIH 1999, IICRC 2008).

h. Home dwellers' decisions that have ***increased*** risks of moisture accumulation and microbial growth include:
   1. Failing to use either fans or window openings to effectively exhaust humid air from cooking or from baths and showers, especially in small homes or apartments with many people or long cooking operations that lead to a large percentage of hours per week or month at a high indoor dew point.
   2. Failing to effectively exhaust (or dehumidify) humid air from clothes driers or drying racks. The problems associated with this error are especially severe during cold weather.
   3. Growing an unusually large number of live plants indoors without exhausting or otherwise removing the humidity they produce. The problems created by this oversight are especially severe in cold climates.
   4. In cold weather, humidifying the indoor air to dew points high enough to create conditions where there are entire days or weeks of condensation or surface RH above 80% inside cooled walls and attics.
   5. Storing large amounts of documents, furniture, or cardboard boxes in damp basements or crawlspaces or in contact with cold exterior walls or foundations.

i. Public policy and building code decisions that have ***reduced*** the risks of moisture accumulation and microbial growth include:
   1. Water barrier requirements. A requirement for a continuous, sealed water barrier in the outer layers of exterior walls and foundation can be very helpful in keeping rainwater from leaking inward into more moisture-sensitive components of the building. This is particularly helpful behind brick veneer, masonry, and stucco cladding, which can all retain a great deal of rainwater. When retained and driven by solar heat, water can move into the building unless there is a vented air gap and a continuous, well-sealed water barrier to protect the inner layers of the exterior wall (ASHRAE 2009a).
   2. Air barrier requirements. Air barrier requirements (in particular, the mid-construction measurement of the air leakage rate of a building against some allowable code-required maximums) is a proven means of reducing both energy consumption and reducing risk of moisture accumulation caused by humid air infiltration (ASHRAE 2010b, ASHRAE 2009a, ASHRAE 2011b, Harriman and Lstiburek 2009).

j. Public policy and building code decisions that have ***increased*** the risks of moisture accumulation and microbial growth include:
   1. Unwise or overly restrictive vapor retarder requirements. Wholesale adoption of prescriptive vapor barrier requirements generated for cold climates have proven to be destructive for buildings in hot and humid climates.

      Placement of vapor barriers does not easily lend itself to simple or global prescriptive requirements. In place of prescriptive requirements, ASHRAE recommends adoption of ASHRAE Standard 160 (ASHRAE 2009a) guidelines for envelope design decisions regarding the need for or the lack of need for vapor barriers and vapor retarders in a specific building assembly in a specific climate and for a specific building use.

When code authorities decide that adoption of Standard 160 guidelines by themselves will not be sufficiently specific and that prescriptive requirements for vapor barriers are useful and necessary, ASHRAE recommends that requirements be specific to the local climate, the type of building, and the magnitude of the building's internal humidity loads. Narrowing the scope of any prescriptive vapor barrier requirement helps limit its potential for creating more problems than it solves (Harriman and Lstiburek 2009).

2. Energy-saving operational practices and regulations can inadvertently increase risks of moisture accumulation and mold growth. Any energy-saving regulations or recommendations should take into account the fact that when excessive moisture and high humidity are present indoors, the risk of mold growth and moisture-related problems is also high.

   For example, if local regulations for public buildings require resetting a chilled-water temperature to a higher level when the building is unoccupied, and if that system is responsible for dehumidification in addition to cooling, the indoor dew point can rise to excessive, even risky levels. And if regulations require that parts of a building be uncooled when other parts of the same building are cooled, as in the case of health care facilities in many parts of the world, the dew point in uncooled parts of the building can rise high enough to create high surface RH and microbial growth on (or inside) walls separating cooled and uncooled spaces.

   Consequently, ASHRAE suggests that regulations that govern cooling not overlook the need to keep the indoor dew point low enough to reduce the risk of high surface RH in cooled parts of a building, especially when other parts of a building are not cooled or are intermittently cooled.

INVESTIGATION AND REMEDIATION OF MOLD AND MICROBIAL GROWTH PROBLEMS

Although many ASHRAE members may be qualified by training and/or experience to investigate and remediate microbial problems including mold, these skills are not overseen, collected, or codified by ASHRAE technical committees. Consequently, ASHRAE takes no position on the question of certification or accreditation of technical competence in these areas.

As technical professionals, however, ASHRAE members and technical committees have observed the following:

1. In the U.S., no cognizant health authority has yet established microbial exposure limits for residential or commercial buildings. In other countries, such exposure limits have been established (Brandys and Brandys 2011), but there is little agreement between different countries concerning what the limits should be to ensure acceptable levels of health risk.
2. Other organizations have published detailed guidance on the assessment of fungal growth in buildings (ASTM 2010), on the appropriate assessment of the presence of or exposure to bioaerosols (ACGIH 1999), and on appropriate investigation and remediation of moisture and mold problems in buildings (AIHA 2008). These references provide useful guidance to those who need to investigate, assess, and deal with any consequences of mold and other microbial growth in buildings and residences.
3. Sampling for airborne mold spores is often utilized to assess the degree of contamination of the indoor air, especially following mitigation of a mold problem. However, cognizant authorities for these techniques advise that air sampling for mold spores should only be

conducted with a hypotheses-driven sampling plan that provides a sufficient number of sample locations and air samples to provide a statistically relevant interpretation. Furthermore, spores are not the only component of microbial growth that is of concern. While presence of an unusual number of mold spores may be a relatively reliable indicator of "a microbial problem," the absence of spores is not a reliable indicator of absence of "a microbial problem" (ACGIH 1999).

4. The moisture content of materials is a key aspect of assessing the risk of microbial growth on their surfaces. However, ASHRAE advises caution when taking moisture content readings and interpreting their significance. There is nearly always extreme spatial variation in the moisture content of materials over short distances (a few inches or centimeters). Also there are many different materials in a building, each with different wetting and drying characteristics and different susceptibility to moisture problems over both short and long periods.

   These factors, combined with normal daily temperature cycles that affect wetting and drying, suggest that any single-point or single-event moisture content measurement is not likely to be useful in assessing the presence or absence of excessive moisture accumulation or mold risk. As a further complication, different moisture meters are calibrated to different scales. The readings from one type of meter—or even different models of the same type of moisture meter—may have no definable or consistent correlation with readings from a different type of meter (Harriman and Lstiburek 2009).

   Mapping the moisture measurements, taking measurements in the exact same location over time with the same meter, and using thermal cameras to help locate areas of potential concern can reduce (but not eliminate) the high level of uncertainty associated with conclusions based on current moisture measurement technology.

5. Wetting events associated with rainwater leakage, wind-driven rain, and condensation indoors are common sources of moisture accumulation and microbial problems, including mold. Investigations that occur only on dry days, or on days without wind-driven rain, may fail to identify and locate such leakage. The same is true for periodic HVAC malfunctions such as shortcomings in the control systems during shutdown or lightly occupied periods. Consequently, multiple site visits during different weather conditions and different HVAC operational modes may sometimes be necessary to reach robust conclusions.

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FACT SHEET

NEW YORK STATE OF OPPORTUNITY. | Safety and Health

Mold Assessment and Remediation in New York State

What is Mold?

Mold is a multi-cellular fungus, similar to mushrooms and yeast. Mold can be different colors, and look fuzzy, slimy, or powdery. It often has a musty odor when present in large amounts.

Mold requires three things to grow:

- water/moisture,
- organic food source (paper, fabric, sheetrock, etc.), and
- proper temperature.

The presence of mold means there is too much moisture. Moisture problems can be caused by:

- plumbing leaks
- leaking roofs or windows
- high humidity
- flooding
- condensation due to poor ventilation or insulation

It is impossible to 'mold proof' your house. However, you can manage mold growth by controlling indoor humidity levels and fixing water leakage problems. To prevent mold from coming back in the future, you must fix the underlying source of moisture.

If I want to clean up mold, do I need to hire a mold professional?

No. Mold issues can often be fixed by the property owner. However, if you are sensitive to mold, not interested in cleaning up the mold or are not capable of cleaning the mold, you can hire mold professionals.

Does New York require a property owner to clean up mold when it is found?

No, there is no cleanup requirement for property owners. However, if a property owner chooses to hire a mold professional, those professionals must follow the requirements of the law.

Note: Rental property owners must still provide clean and sanitary living conditions to their tenants.

How does the Department of Labor help with mold issues?

The Department of Labor makes sure that professionals who do mold assessments and remediation work have proper training, licenses and minimum work standards.

Every mold cleanup project performed by professionals must follow these steps: assessment, remediation (clean up), clearance. The law protects consumers by barring licensed mold companies and their employees from doing both the assessment and remediation on the same property. One mold company and their employees may do the initial and post-cleanup clearance assessments, but a different company and their employees must do the actual cleanup work.

Assessments

What is an assessment?

An assessment, or a mold remediation plan, is a document prepared by a mold professional. It identifies mold and serves as a guide for the cleanup project. It says what must be done, how it is to be done, and how you will be able to tell if all the mold has been removed. The specific requirements are listed in Section 945 of the Labor Law.

Am I entitled to a copy of the assessment?

Yes. If you hire a mold professional to do an assessment, you must be given a copy. The professional you hire to do the remediation work must also get a copy.

Does a mold assessor need to perform sampling as part of an assessment?

No. In most cases, air sampling and mold testing are not necessary. There are no national or state standards for “safe” levels of mold. Mold spores are a natural part of the environment and are always in the air and on surfaces. A thorough visual inspection is the most important step to identify mold problems and determine cleanup strategies. Before contractors perform any sampling or testing, ask what type of sampling or testing they wish to perform, why it is necessary, and what it will show that is not already known.

How much should an assessment cost?

The law does not say how much an assessment should cost. We recommend that you get estimates from different companies. If a contractor recommends testing as part of an assessment, you should have a clear understanding of the costs for that testing and exactly what the testing will show.

Remediation

What does the Mold Remediation Contractor do?

The remediation contractor does the actual cleanup work. They must give you a mold remediation work plan. The work plan must fulfill all the requirements of the mold remediation plan developed through the assessment.

Hiring a Mold Professional

What should I know before hiring a mold professional?

As is true with all construction projects, the most important step is choosing your contractor. Contact more than one contractor for all work to be performed.

- For Mold Assessment: Make sure each contractor comes to the job site and bids on the same work. Before any work starts, you should have a clear understanding of the scope of work and the services the contractor will provide. You should understand and agree with the mold assessor’s remediation plan for acceptable work scope and job clearance. This may include sampling, recommended use of biocides or other chemicals, replacement of materials, and criteria to demonstrate clearance after the cleanup.
- For Mold Remediation: The work plan must fulfill all the requirements of the mold remediation plan developed through the assessment. The work plan should also have specific instructions and/or standard operating procedures for how the contractor will perform the cleanup work.

Ask about the contractor’s experience and references from previous clients. If you are not sure that the proposed work complies with local building code rules, contact the local building code office before allowing the contractor to start work.

How can I verify that a Mold Assessor or Mold Remediation Contractor is licensed by NYSDOL?

Visit the Department of Labor’ s website and use the “Licensed Mold Contractors Search Tool” at: https://www.labor.ny.gov/workerprotection/safetyhealth/mold/licensing.shtm

How can I file a complaint if I do not believe the mold professionals followed this guidance?

Submit the “Mold Contractor Complaint Form” at: https://www.labor.ny.gov/workerprotection/safetyhealth/mold/compliance.shtm

Where do I go for more information?

New York State Department of Labor: http://labor.ny.gov/mold
New York City Department of Health and Mental Hygiene: http://www1.nyc.gov/site/doh/health/health-topics/mold.page
U.S. Environmental Protection Agency: https://www.epa.gov/mold

FACT SHEET

NEW YORK STATE OF OPPORTUNITY. | Safety and Health

What to Expect When You Hire a Mold Assessor and Mold Remediation Contractor

When does a property owner have to hire a Mold Assessor or Mold Remediation Contractor?

The New York State Department of Labor does not require you to clean up mold on your property. However, if you decide to have someone assess and remediate an area of mold that is larger than 10 square feet of mold, you must use a licensed mold professional to do the work. You must first have a Mold Assessor do an inspection and complete a Mold Remediation Plan. You will then hire a Mold Remediation Contractor to do the work outlined in the plan.

When you hire a mold professional for a mold project, the mold professional must perform their duties in accordance with the New York State Mold Law, Article 32, "Licensing of Mold Inspection, Assessment and Remediation Specialists and Minimum Work Standards." This fact sheet provides guidance so you know what to expect.

What are the main responsibilities of a Mold Assessor?

- Have a valid Mold Assessor License from the New York State Department of Labor for the company and employees.
- Perform the **initial** visual inspection and assessment of the property for mold growth. This may include the use of a moisture meter and, in rare cases, mold sampling.
- Identify the underlying source of moisture causing the mold growth (when possible).
- Educate the property owner on the Mold Law and mold in general.
- Develop a Mold Remediation Plan. This plan will identify:
  - The source of the moisture causing mold growth,
  - How to remedy the moisture issue,
  - The mold remediation methods to be used for cleanup, and
  - The criteria that must be met to consider the cleanup complete.
- Perform a post-remediation assessment to confirm the remediation was successful.
- Develop a written passed clearance report or final status report.

Why is mold sampling rarely recommended?

- Mold is a natural part of the environment. There is always some mold in the air and on surfaces.
- Sampling will almost always reveal the presence of mold or mold spores.
- There are no national or state standards for comparing or analyzing mold samples.
- There are no national or state standards to compare the sample results against.
- Unless people are allergic to mold or mold spores, the presence of mold does not usually produce any symptoms.
- Unless you know the specific type (genus and species) of mold to which someone is allergic, this information is not typically useful.

What should the Mold Assessor put in the *Mold Remediation Plan*?

The *Mold Remediation Plan* is specific to each project. The purpose of this plan is to provide methods to eliminate the moisture source(s) and visible mold growth. The plan should include:

- A description of the rooms or areas where the remediation will be performed,
- An estimate of the quantity of material to be cleaned or removed,
- A description of the abatement methods to be used for each type of remediation in each area,
- A proposal for containment, when needed, to prevent the spread of mold,

- A list of recommended personal protective equipment for abatement workers (to be provided by the Remediation Contractor),
- A list of clearance procedures and criteria for each type of remediation in each area,
- For an occupied property, recommendations for notice to occupants and posting requirements that are appropriate for the project,
- An estimate of cost and time for completion of the project,
- Information on the use of any United States Environmental Protection Agency (USEPA) registered disinfectant, biocide, or antimicrobial coating being considered, taking into account the potential for occupant sensitivities to such products, and
- Identification of the underlying source(s) of moisture, when possible, that may be causing mold growth and recommendations for the type of contractor who would be able to fix the issue.

Note: It is always recommended to correct the underlying source of water/moisture before cleaning up mold growth or the mold will likely grow back.

How is the *Mold Remediation Plan* used?

The Mold Assessor must give you, the client, the *Mold Remediation Plan* before the cleanup project begins. You should understand and agree with the plan.

You will then give the *Mold Remediation Plan* to Mold Remediation Contractors you may want to hire to do the work. This will give them the information they need to give you a cost estimate for the work.

What are the main responsibilities of a Mold Remediation Contractor?

- Have a valid Mold Remediation Contractor License from the Department of Labor for the company.
- Ensure workers on projects have Mold Abatement Worker licenses from the Department of Labor.
- Prepare a *Mold Remediation Work Plan*. This plan gives instructions and standard operating procedures for how they will do the cleanup work described in the *Mold Remediation Plan*. This plan may also include containment construction and other equipment necessary to prevent the spread of mold spores during the abatement.
- The Mold Remediation Work Plan must be given to you **before** cleanup work starts.
- Perform the physical removal, cleaning, sanitizing, surface disinfection or other work that is needed to clean up the mold, in accordance with general industry-accepted standards.

Note: Mold remediation contractors are not required to remedy the source of the moisture that caused the mold if they do not have the required expertise to do so.

What precautions must be taken when disinfectants, biocides and antimicrobial coatings are used during mold remediation?

Disinfectants, biocides and antimicrobial coatings registered with the USEPA may only be used if they are specified in the Mold Remediation Plan. These chemicals must be used only for their intended purpose. They should also only be applied according to the manufacturer's labeling instructions. The Mold Assessor and the Mold Remediation Contractor must consider the potential for people who occupy the property to be sensitive or have a negative reaction to the chemicals.

When is a mold remediation project complete?

Once your Mold Remediation Contractor has done the work, the Mold Assessor must do a post-remediation assessment. The project is complete when the Mold Assessor issues a written passed clearance report that states:

- the work area is free from all visible mold,
- all work has been done according to the *Mold Remediation Plan* and *Mold Remediation Work Plan*, and
- the clearance criteria listed in the *Mold Remediation Plan* was met.

If the cleanup work was not successful, the Mold Assessor will write a final status report listing what needs to be done to receive a passed clearance report. The final status report will be given to you and the Mold Remediation Contractor.

You should use the same Mold Assessor who wrote the *Mold Remediation Plan* to do the post-remediation assessment, but this is not required.

The Mold Remediation Contractor may not remove materials or dismantle containment structures until you get a passed clearance report.

Note: If you decide not to have a post-remediation assessment, the Mold Assessor and Mold Remediation Contractor should get documentation that you accept the work as is before they leave the property.

Where can I find more information on general industry accepted practices for mold remediation?

- New York City Department of Health and Mental Hygiene: http://www1.nyc.gov/site/doh/health/health-topics/mold.page
- New York State Department of Health: https://www.health.ny.gov/publications/7287/
- U.S. Environmental Protection Agency: https://www.epa.gov/mold
- Institute of Inspection, Cleaning and Restoration Certification: http://www.iicrc.org/standards/iicrc-s520/

How can I verify that a Mold Assessor or Mold Remediation Contractor is licensed by the Department of Labor?
Visit the Department of Labor's website and use the "Licensed Mold Contractors Search Tool" at: https://www.labor.ny.gov/workerprotection/safetyhealth/mold/licensed-mold-contractors-search-tool.shtm

How can I file a complaint if I do not believe the mold professionals followed this guidance?
Submit the "Mold Contractor Complaint Form" at: https://www.labor.ny.gov/workerprotection/safetyhealth/mold/compliance.shtm

NEW YORK STATE OF OPPORTUNITY. | Department of Labor

Division of Safety and Health
Harriman State Office Campus
Building 12, Room 167
Albany, NY 12240
(518) 457-1255
www.labor.ny.gov

For DOL Use Only: MC - ____ - __________

Mold Contractor Complaint Form

Purpose: The information you report on this form will be used to investigate violations of Article 32 of the New York State Labor Law.

Please Note:
A. If the mold-affected area is less than 10 square feet, be advised that the Mold Law does not apply.
B. Please send the completed form and any attachment(s) to the address of your local district office, which may be found at the end of this form, or electronically in a PDF format to moldcomplaints@labor.ny.gov.

Instructions: Please type or write legibly. Please provide as much information as possible using this form and include all relevant documents. A representative from the Department may contact you if additional information is needed.

1. Complainant Information

Name: ______________________________ ______________________________
First Last
Address: ______________________________
City: ______________________________ State: __________ Zip Code: __________
Phone: ( ) __________ - __________ Email: ______________________________

2. Information on Mold-Affected Property

What is the relationship between the complainant and the mold-affected property?
☐ Owner Occupant ☐ Landlord ☐ Tenant ☐ Other: __________________
Is the affected property's address the same as the home address above? ☐ Yes ☐ No
If it is not the same, provide the mold-affected property address below:
Affected Property's Address: ______________________________
City: ______________________________ State: __________ Zip Code: __________
Property Type: ☐ Single Family ☐ Apartment ☐ Commercial
☐ Industrial ☐ Multi Family: Number of Units: ______ ☐ Other: __________

3. Business or Individual Complaint is Against

Which group(s) of mold professionals do you have a complaint against?
☐ Mold Assessor ☐ Mold Remediation Contractor ☐ Mold Abatement Worker

Please provide the following information for the Mold Professional you have a complaint against:
Mold Professional's Name: ______________________ ______________________
First Last
Mold Professional's License No. (if known): __________
Mold Professional's Contractor License No. (if known): __________
Type of Business (if known): ☐ Sole Proprietor ☐ Company
Business Name: ______________________ Business Website: ______________________
Business Address: ______________________________
City: ______________________________ State: __________ Zip Code: __________

SH 140 (12/16)

How did you hear about the Mold Professional? ☐ TV ☐ Print ☐ Website ☐ Radio ☐ Other:_________

Have you complained to the business? ☐ Yes ☐ No

If the answer is yes, how did you communicate your complaint?

☐ E-mail ☐ Phone ☐ In Person ☐ Letter ☐ Other: _____________

Did you sign a contract/proposal with the Mold Professional to perform the work?

☐ Yes – **Please provide a copy of the contract/proposal.** ☐ No

Was any plan or work plan provided to you by the mold professional?

☐ Yes – **Please attach a copy of the plan/work plan.** ☐ No

What is the nature of your complaint(s)? Please check the appropriate box(s). If you did not see the category of your complaint(s), please check 'Other' and provide a brief description. You may provide a more detailed description in the next section.

☐ Unlicensed or expired license for company and/or worker.
☐ Contractor performed mold assessment and mold remediation on the same property.
☐ Inadequate mold assessment.
☐ Inadequate mold remediation.
☐ Abatement workers not following the Mold Remediation Work Plan.
☐ No or failed post-remediation clearance inspection.
☐ Other (Please Specify Briefly):____

____

4. Detailed Complaint Write-up

Please describe your complaint in detail (attach extra sheets if necessary). Include the names of individuals you have dealt with, dates and outcome(s) of your dealings, and enclose copies of all contracts, receipts, correspondence, and other documents you have related to this complaint.

Date(s)	Description

Do not mark in this box. For DOL internal use only.
VC: ___Y ____N Assigned to: _____________________Region:______ Date Processed: __________

SH 140 (12/16)

Where to send your complaint form and attachments:

Albany District

Counties: Albany, Clinton, Columbia, Dutchess, Essex, Fulton, Green, Montgomery, Orange, Putnam, Rockland, Rensselaer, Saratoga, Schenectady, Schoharie, Sullivan, Ulster, Warren, Washington

State Office Campus, Room 166, Albany, NY 12240
Phone: (518) 457-2072
Fax: (518) 485-8054

Buffalo District

Counties: Allegany, Cattaraugus, Chautauqua, Erie, Genesee, Livingston, Monroe, Niagara, Ontario, Orleans, Wayne, Wyoming, Yates

65 Court Street, Room 405, Buffalo, NY 14202
Phone: (716) 847-7126
Fax: (716) 847-7138

New York City District

Counties: Bronx, Kings, Nassau, New York, Queens. Richmond, Suffolk, Westchester

One Hudson Square, 75 Varick Street (7th Floor), New York, NY 10013
Phone: (212) 775-3532
Fax: (212) 775-3535

Syracuse District

Counties: Broome, Cayuga, Chemung, Chenengo, Cortland, Delaware, Franklin, Hamilton, Herkimer, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, Otsego, St. Lawrence, Schuyler, Seneca, Steuben, Tioga, Tompkins

450 S. Salina Street, Syracuse, NY 13202
Phone: (315) 479-3303
Fax: (315) 479-3333

Disinfectants	**Sodium Hypochlorite <5%**	**Quaternary Ammonium Compounds**	**Hydrogen Peroxide <8%**	**Thymol**	**Phenols**
Disinfection Level	Low / Intermediate	Int / High (~40-130 org)	High	Low ~15 orgs	Low
Stain Removal	Fast and effective at removing stains	Lightens staining by killing organisms	Effective at lightening staining at <8% with addition of surfactant	Ineffective at stain removal	Ineffective at stain removal
Health risks	Irritant to mucous membranes, eyes and skin. If mixed with ammonia or acidic products can create poisonous gas.	Can cause dermatitis. Irritant to mucous membranes. Can trigger asthmatic symptoms.	Irritating to eyes, skin at mucous membranes at >6% concentration.	Irritating to eyes, skin at mucous membranes	Irritant to mucous membranes, eyes and skin.
Controls	Personal protective equipment (w / full dermal protection) and increased ventilation.	Personal protective equipment and increased ventilation.	Personal protective equipment (w / dermal protection) including goggles and increased ventilation.	Personal protective equipment (w / dermal protection) including goggles and increased ventilation.	Personal protective equipment and increased ventilation.
Competitive Products	Bleach	Anabec Anashpere, Fiberlock Shockwave, Foster 4080	Fiberlock Advanced Peroxide Cleaner	Concrobium Disinfectant, Botaniclean Benefect	Sporicidin
Environ-mental Issues/ Disposal	Toxic to aquatic organisms.	Toxic to aquatic organisms.	Small amounts can be flushed down a sink with a large quantity of water. Larger amounts should be treated before disposal.	Toxic to aquatic organisms.	Toxic to all animals including aquatic organisms. Remains persistent in the environment. Subject to disposal restrictions.
Shelf Life	3months. Keep in an airtight container away from light.	2 years in an airtight container if undiluted. Reality is much longer.	2 years in an airtight container away from light.	Stable	1 year in a sealed container.
Packaging	Plastic	Plastic	Plastic vented	Plastic	Plastic
Shipping	As RTU PG III – Class 5.2 Max packaging qty 8 gal	As Concentrate PG III, Small quantity exemption As RTU – not regulated	>8% to <20% - PG III Oxidizer - Max packaging qty 4 gal <8% – Not regulated	As RTU PG III – Class 5.2 Max packaging qty 8 gal	2% (typical use range) - Not regulated
Disadvantages	• Can cause damage to floor finishes, metals, carpets, clothing and other fibers at use concentrations. • Must be stored separately from most chemicals. • Rinsing required in applications where direct skin or oral contact occurs. • Inactivated in the presence of organic matter, biofilm and by light and some metals. • No residual activity. • Not recommended for porous materials	• Can easily become contaminated. • Leaves residue, rinsing required. • QUATs are generally inactivated by organic matter, some soaps and hard water with the exception of newer fourth generation QUATs.	• >7.5% hydrogen peroxide can cause discoloration of black anodized metal finishes and bleaching of fabric. • Cosmetic and functional material compatibility concerns with brass, zinc, copper, and nickel/silver plating. • Inactivated by organic matter.	• Can cause damage to floor finishes, metals, carpets, clothing and other fibers at higher concentrations. • Must be stored separately from ammonia and flammable products. • Rinsing required in applications where direct skin or oral contact occurs. • Inactivated in the presence of organic matter and by light and some metals.	• Not for use on food preparation surfaces or food utensils and in nurseries or schools. • May damage floor finishes and other surfaces. • Leaves residue, rinsing required. • Not effective against non-enveloped viruses such as norovirus and spores and some gram-negative bacteria.
Advantages	Can kill spores at high concentrations. Broad spectrum of antimicrobial activity. Does not leave toxic residues, unaffected by water hardness, and fast acting.	Does not cause damage to surfaces.	Non-corrosive when diluted, no disposal issues, odor or irritation issues. Leave no residue. Biodegradable	Can remove biofilms and kill spores at high concentrations. Broad spectrum of antimicrobial activity. Does not leave toxic residues, unaffected by water hardness, inexpensive and fast acting.	Maintains some activity in hard water and in the presence of organic matter and has some residual activity after drying.

Mold Cleaners	Sodium Hypochlorite >5.25%	Hydrogen Peroxide (<8%)	Hydrogen Peroxide (18-20%)	Powdered Percarbonate	Enzymes
Packaging	Plastic Ready to Use - Liquid	Plastic vented Ready to Use - Liquid	Plastic vented Ready to Use - Liquid	Plastic vented Concentrate – Powder	Plastic Concentrate – Liquid
Shelf Life	3 -4 months in an airtight container away from light.	2 years in an airtight container away from light.	2 years in an airtight container away from light.	1 year in container. Reduce heat / moisture exposure	2 years in an airtight container away from light.
Shipping	As RTU PG III – Class 5.2 Max packaging qty 8 gal Best Shipping:LTL	<8% – Not regulated Best Shipping: FedEx / UPS or LTL	>8% to <20% - PG III Oxidizer – Max packaging qty 4 gal Best Shipping:LTL	<60% Percarbonate – Not regulated Best Shipping:FedEx/UPS >60% PG III Oxidizer Best Shipping:LTL	Not regulated Best Shipping:FedEx/UPS
Products	Fast MMR Packaed in 1 gal & 2.5 gal Coverage: 200 sf / gallon	Anabec Advanced Cleaning Soln Packed in 5 gal pail Coverage: 800-1000 sf / gallon Fiberlock Advanced Perox Cleaner Packed in 5 gal pail Coverage: 200 sf / gallon	Serum 1000 Packed in 5 gal pail Coverage: unclear	Concrobium Paked in 2-1qt Coverage 65 sf/gal	Sporicidin Package Various Coverage: 1000 sf/gal
Pre-cleaning required?	Yes – when significant organic debris present.	No – This is the first step in their mold cleaning process.	No – This is the first step in their mold cleaning process.	No – this is the first step in their mold cleaning process.	No – this is the first step in their mold cleaning process.
Post-cleaning required?	Yes – HEPA vac / Surface rinse to reduce chlorine on some surfaces	Yes – HEPA Vac	Yes – HEPA Vac	Yes – HEPA Vac	Yes – HEPA Vac
Stain Removal	Very effective	Effective	Effective	Effective	Varied results based on stain chemistry
Timing	Almost immediate	1 day to see final results	1 day to see final results	30 m - 1 hour to activate 2 hour lifespan of mixed product 1 day to see final results	Up to 3 days to see final results
Disinfection Properties	Yes – High	Yes – High	Yes – High	Yes – High	No
PPE / Environmental Controls	Personal protective equipment (w / full dermal protection), respirator and increased ventilation.	Personal protective equipment (w / full dermal protection) respirator and increased ventilation.	Personal protective equipment (w / full dermal protection) respirator and increased ventilation.	Personal protective equipment (w / full dermal protection) respirator and increased ventilation.	Personal protective equipment (w / dermal protection) respirator and increased ventilation.
Health risks	Extreme irritant to mucous membranes, eyes and skin, to the point where chemical burns can occur. If mixed with ammonia or acidic products can create poisonous chlorine gas.	Irritant to mucous membranes, eyes and skin at use concentration.	Irritant to mucous membranes, eyes and skin at use concentration. Can bleach skin and hair	Irritant to mucous membranes, eyes and skin at use concentration.	Irritant to mucous membranes, eyes and skin at use concentration.

Mold Cleaners	**Sodium Hypochlorite >5.25%**	**Hydrogen Peroxide (18-20%)**	**Hydrogen Peroxide (18-20%)**	**Powdered Percarbonate**	**Enzymes**
Environmental Issues/ Disposal	Highly Toxic to aquatic organisms. Environmental release to be avoided. Any amount flushed down a sink should be accompanied with a large quantity of water.	Small amounts can be flushed down a sink with a large quantity of water. Larger amounts should be treated before disposal.	Small amounts can be flushed down a sink with a large quantity of water. Larger amounts should be treated before disposal.	Small amounts can be flushed down a sink with a large quantity of water. Larger amounts should be treated before disposal.	Small amounts can be flushed down a sink with a large quantity of water. Large quantities can impact septic tank / drain biological activity.
Advantages	Can kill spores at high concentrations. Broad spectrum of antimicrobial activity. Does not leave toxic residues, unaffected by water hardness, inexpensive and fast acting.	Can remove biofilms and kill spores at use concentration. Broad spectrum of antimicrobial activity. Does not leave residues. Biodegradable	Can remove biofilms and kill spores at use concentration. Broad spectrum of antimicrobial activity. Does not leave residues. Biodegradable	Can remove biofilms and kill spores at use concentration. Broad spectrum of antimicrobial activity. Does not leave toxic residues. Biodegradable	Digest stains with bacillus based enzymes. Retains similar bactericidal activity in the presence of organic matter. Biodegradable. Safe for surfaces.
Disadvantages	Will cause damage / bleaching to floor finishes, metals, carpets, clothing and other fibers at use concentrations. Wipe down metals after exposure required. Rinsing required in applications where direct skin or oral contact occurs. Must be stored separately from ammonia and flammable products. Inactivated by heavy biofilms, organic debris, light and some metals. Not effective at cleaning mold from porous surfaces	At use concentration cause discoloration of anodized metal finishes and bleaching of some fabric. Cosmetic and functional material compatibility concerns with brass, zinc, copper, and nickel/silver plating.	At use concentration cause discoloration of anodized metal finishes and bleaching of some fabric. Cosmetic and functional material compatibility concerns with brass, zinc, copper, and nickel/silver plating.	Can cause discoloration of black anodized metal finishes and bleaching of non-colorfast fabric. Cosmetic and functional material compatibility concerns with brass, zinc, copper, and nickel/silver plating.	Slow working. Not compatible with disinfectants.

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Mold Investigation SOP

Date
Job #
Location (Complete Address)
Technician/Cert #

Describe Structure

1. Commercial/Residential
2. Building Materials Exterior (Brick/Siding)
3. Building Materials Interior (Carpet/Wallpaper)
4. Number of Floors (Include Basement & Attic)
5. Draw Floor Plan
    a. Identify Water Intrusion (Moisture Readings)
    b. Identify Standing Water
    c. Identify Visible Mold

Provide Details on Indoor Conditions:

1. Temperature
2. Relative Humidity
3. Air Flow (Open Windows/Doors/Skylights)

Provide Details on Exterior Conditions:

1. Temperature
2. Relative Humidity
3. Precipitation

Conduct Visual Inspection of Property:
Provide Details for the Following:

1. Affected Components in the Structure
2. Visible Water Damage
3. Visible Mold Growth
4. Moisture Reading
5. Samples (Bulk/Air/Tape Lift)

General Notes:
Complete Chain of Custody, ID samples in tracking binder, send samples to appropriate lab via lab specific shipping method
Complete folder, place in appropriate file (reports to be built)
Review results, complete report, deliver (email/hard copies)
Invoice

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OCCUPANT INTERVIEW FORM

1. INFORMATION

☒ Client/Project Name:____

☐ Address:____

☐ Name of Occupant:____

☐ Form applies to evaluation of: ☐ Home ☐ Workplace Date:____________________

☐ Interviewer name: ____

☐ NYSDOL Mold Assessor Cert#: ____

2. OCCUPANT HISTORY

☐ Full Name: ____

☐ Address/Department: ____

☐ Phone: (H)________________________ (W)________________________

☐ Email: ________________________ Fax ________________________

☐ Age: ____________ Sex ☐ M ☐ F Occupation: ________________________

☐ Ages of family members (if home evaluation): ________________________

☐ Length of occupancy: ________Years________

☐ Where do you spend most of your time in the building? ________________________

☐ Smoke tobacco? ☐ Yes ☐ No

3. BUILDING HISTORY

☐ Approximate age of the building: __________ years

☐ Aware of any renovations or change in use? ☐ Yes ☐ No

☐ Approximate year and nature of renovation:

- Year: ________ Change: ________________________________
- Year: ________ Change: ________________________________
- Year: ________ Change: ________________________________
- Year: ________ Change: ________________________________

☐ Are there drawings available for building design? ☐ Yes ☐ No

Source or Location: ____

4. OCCUPANT INTERVIEW FORM

☐ Building is: ☐ Heated ☐ Air conditioned ☐ Naturally Ventilated

☐ Type of HVAC system: ______________________ Who maintains HVAC? _________________________

☐ Is your building often too hot? ☐ Yes ☐ No Too cold ☐ Yes ☐ No

Description: ____

☐ Thermostat Setting: ☐ Constant ☐ Changed at night ☐ Off when away

Spaces are: ☐ Maintained at same temperature

☐ Some are kept cooler (list)

____

____

5. OBSERVED MOISTURE AND MOLD OR MILDEW PROBLEMS

☐ Have you ever observed any leaks or moisture problems? ☐ Yes ☐ No

☐ Have you ever observed any mold or mildew in the building? ☐ Yes ☐ No

Describe exact locations: ____

____

☐ Are there any unpleasant odors in the building? ☐ Yes ☐ NO

☐ Musty ☐ Earthy ☐ Smokey ☐ Dusty ☐ Stale ☐ Rotten ☐ Chemical ☐ Petroleum

Other: ____

Locations: ____

When last noticed: ____

☐ When and where is it convenient to contact you if further questions arise?

☐ Day ☐ Evening ☐ Work ☐ Home ☐ Phone ☐ Fax ☐ Email

☐ Do not contact me again

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Mold Assessment Background Data and Observation Form

Date: ____________________ Project Address: ____________________________

Project #: _________________ Project Name: ______________________________

Assessor: ____________ Client: ____________________________________

Background Information

Property type (circle one): Residential or Commercial or Other Date of Construction: ___________

Owner occupied or rental: ___________________________ Is the building currently occupied? ___

Brief description of use of structure:

____

____

____

List Areas to be assessed if not whole structure:

____

____

____

Summary of interview with owner and/or occupant: Person interviewed:__________________________________

____

____

____

Location and Type of HVAC

____

Data Collection: (also complete Mold Assessment Worksheet)

Ambient Conditions (exterior):

Temperature: _____________________ Humidity: _____________________ Precipitation: _______

Interior Conditions:

Temperature: _____________________ Humidity: ______________________

Affected Area:

Temperature: _____________________ Humidity: ______________________

Notes and Observations:

____

____

____

____

____

____

Is mold remediation recommended (if so fill out Mold Remediation Plan Work Sheet) Yes or No

Signature: ____

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Mold Investigation Data and Observation Form

Date:
Job #:
Location:
Staff Name:

Indoor Conditions
Temperature:
Relative Humidity:

Exterior Conditions
Temperature:
Relative Humidity:
Precipitation:

Visual Inspection

Component	Visible Water Damage	Visible Mold Growth	Moisture Reading	Samples

Notes:

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Mold Assessment Worksheet

Date: ____________________ Project Address: ______________________________ Project Name: _________

Project #: _________________ Assessor: ___________________________________ Client: _______________

Assessment Area (Room And floor)	Component	Visible Mold Growth (if yes quantity)	Visible Water Damage (if yes what is source)	Moisture Readings (%)	Sample # (as applicable)	Sample Type (as applicable)	Notes

Signature: ___________________________________

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Mold Remediation Plan Worksheet

Date: ____________________ Project Address: ______________________________ Project Name: ________

Project #: ________________ Assessor: ___________________________________ Client: _____________

Work Area Designation (Room and Floor)	Estimated quantity of materials to be cleaned	Estimated quantity of material to be removed/disposed	Possible cause of moisture and type of contractor to repair	Containment	Remediation Methods	Clearance Method	Estimated Cost and Time Frame

Signature: ___________________________________

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Field Site Maps

Project Name/ Address: North

Floor/ Area Designation: Job #:

Technician: Date:

Legend:

Not To Scale

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HAYES MICROBIAL CONSULTING

Chain of Custody

3005 East Boundary Terrace / Suite F
Midlothian, VA 23112
Ph. 804.562.3435 Fax. 804-447-5562

HMC Report #

	Job Number:	Date Collected:
	Job Name:	Collected by:
Ph.: Fax:		Email:

Sample #	Sample Name	Analysis Type	Volume	Turn Around Time	Start / Stop Time

Analysis Type		Description	Turn Around Time	Acceptable Samples Types
Spore Trap	S	Identification & Enumeration of Fungal Spores	24 hours	Spore Trap cassettes, Impact slides
	S+	I & E of Fungal Spores + total dander, fiber and pollen count	24 hours	Spore Trap cassettes, Impact slides
Direct ID	D	ID and Semi-quantitative enumeration of spores and mycelium	24 hours	Tape, Bio-tape, swab, bulk, agar plate for ID only
	D+	ID and Enumeration with spore count	24 hours	Tape, Bio-tape, swab, bulk, agar plate for ID only
Culture	C1	Identification & Enumeration of Mold only	7 days	Anderson Air Plate, Swab, Bulk
	C2	Identification & Enumeration of Bacteria only	4 days	Anderson Air Plate, Swab, Bulk
	C3	Identification & Enumeration of Mold and Bacteria	7 days	Anderson Air Plate, Swab, Bulk
Dust Mite	A1	Semi-quantitive analysis of dust mite allergen	24 hours	Bulk Dust

Notes:					
Relinquished By:		Date:	Rcvd. By:	Date:	Time:

Mold Post Remediation Record

Date: ____________________   Project Address: ______________________________

Project #: _________________   Unit/Apt: ___________________________________

Assessor: _______________   Client: ______________________________________

License #: _______________

Remediation performed by:

Company name: _______________________________   Date and Time of Final Clean: _________________

Company Address: _____________________________   Is this a repeat clearance: Yes or No____________

____   Remediation Supervisor: _____________________

Work Area Designation (rooms and floor): ____

Work Area Description (including quantities): ____

____

Criteria	Pass/Fail	Notes
Visible mold observed?		
Work Done in Compliance with remediation plan		
Moisture Readings		
Visible dust/debris		
Air Samples (if applicable)		
Swab/Tape Samples (if applicable)		
Remediation Project		

Notes:

____

____

____

____

____

____

Signature: ____

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17 September 2015

MOLD ASSESSMENT REPORT & REMEDIATION PLAN

1313 Mockingbird Lane
Black Rock, NY

UNYSE PROJECT: 14-1120JGB

PREPARED FOR:

Herman Munster
1313 Mockingbird Lane
Black Rock, NY 14207

PREPARED BY:

UNYSE
346 AUSTIN STREET, BUFFALO, NY 14207

UNYSE ENVIRONMENTAL CONSULTANTS unyse.net

UNYSE ENVIRONMENTAL CONSULTANTS unyse.net

September 17, 2015

Herman Munster
Lilly Apartments, Inc.
1313 Mockingbird Lane
Black Rock, NY 14207

Re: Mold Assessment Report & Remediation Plan
1313 Mockingbird Lane
Black Rock, NY 14207

Dear Mr. Munster

Please accept our Mold Assessment Report and Remediation Plan for the above referenced location.

Part 1 - Executive Summary" details our services. Part 2 - Data and Observation Forms & Part 3 - Sample Analysis and Transfer Records reflect our site services. Part 4 - Remediation Plan, is designed to meet NYS DOL requirements for a subsequent remediation project. Part 4 is photos taken during our assessment and Part 5 is mold remediation guidance relevant to this project.

Please provide Part 4- Remediation Plan to a Mold Remediation Contractor if/when you proceed with a mold remediation project.

Please do not hesitate to contact me if I may provide any additional information.

Sincerely,

Andrew J. McLellan
President

LGB/AJM

877-466-4429

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Mold Assessment Report & Remediation Plan

Re: Mold Assessment Report & Remediation Plan
Lilly Apartments
1313 Mockingbird Lane
Black Rock, NY 14207

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Part 1 Executive Summary

Re: Mold Assessment Report & Remediation Plan
Lilly Apartments
1313 Mockingbird Lane
Black Rock, NY 14207

Management at Lilly Apartments contacted UNYSE on August 14, 2015 regarding concerns about the presence of mold at Avenue A - Building B, Unit C at Lilly Apartments.

UNYSE was advised at that time that an environmental services contractor had conducted mold abatement in late July 2015. Sometime later service building staff had questions as to whether the unit could be re occupied.

UNYSE conducted a site visit on August 20, 2015 to observe conditions, collect samples and prepare remediation recommendations, as necessary.

The unit appeared to be in a very dirty and cluttered condition. UNYSE staff observed Tyvek suits in the garbage cans and a fungus contaminated shower curtain within the unit. It also appeared that a liquid sealer/mold inhibitor product had been applied to all surfaces in the unit including countertops, stoves, and televisions.

Air samples were collected and forwarded for analysis by Super Duper Labs, Inc., Roanoke, VA.

Sample analysis results indicate a presence of airborne mold spores in the dwelling unit well in excess of airborne mold spores outside the unit. This is considered a measure of unacceptable mold contamination.

As such, we recommend that a mold remediation project take place and that thorough cleaning is completed in areas immediately adjacent to the enclosure. A Remediation Plan can be found in Part 4 of this report.

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Part 2 Mold Investigation Data and Observations

Re: Mold Assessment Report & Remediation Plan
Lilly Apartments
1313 Mockingbird Lane
Black Rock, NY 14207

Date of Investigation: 8/20/15

Indoor Conditions: Temperature: 68.2f
Relative Humidity: 39.5

Exterior Conditions: Temperature: 38.9
Relative Humidity: 64.8
Precipitation: light drizzle

Visual Inspection & Sampling Chart

Component	Visible Water Damage	Visible Mold Growth	Moisture Reading	Samples
Living Room Ceiling	Yes	Yes/staining	60 +	#1213742
Kitchen Ceiling	Yes	No	7-11	n/a
Bathroom Ceiling	Yes	Yes	4-9	#1213745
Bedroom	no	Yes/staining	4-11	n/a
Basement Wall at Bottom Stairs	Yes	Yes	60 +	n/a

Ambient/exterior sample # 1213744

- **Notes**; Mold debris within unit. Tyvek suits in garbage can in unit. Overall very unit dirty needs cleaning. Water intrusion from roof above living room.
- Water damage to ceiling in bathroom

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Part 3 Sample Analysis and Transfer Records

Re: Mold Assessment Report & Remediation Plan
Lilly Apartments
1313 Mockingbird Lane
Black Rock, NY 14207

FINAL REPORT

Analyzed By:

Client: UNYSE
Address: 346 Austin Street
Buffalo, NY 14207

Date Received:
Date Reported:

Air Cassette Analytical Report (SOP# 3.24.01)

AmeriSci Number	314111088-01			314111088-02			314111088-03					
Sample Number	1			2			3					
Sample Name	#1213745 Bath			#1213742 LR			#1213744 Ambient					
Analysis Date												
Volume (L)	75			75			75					
Limit of Detection (LOD) (Count/M³)	53			53			53					
Background Density	3			3			1					
Other	Count/M³	%	Raw Count	Count/M³	%	Raw Count	Count/M³	%	Raw Count	Count/M³	%	Raw Count
Pollen	ND	n/a	ND	ND	n/a	ND	ND	n/a	ND			
Fibers	2667	n/a	50	1333	n/a	25	160	n/a	3			
Mycelial Fragments	53	n/a	1	53	n/a	1	53	n/a	1			
Fungal Identification	Count/M³	%	Raw Count	Count/M³	%	Raw Count	Count/M³	%	Raw Count	Count/M³	%	Raw Count
Ascospores	53	<1	1	ND			213	13	4			
Aspergillus/Penicillium	>16000	95	300	>16000	99	300	587	35	11			
Basidiospores	53	<1	1	53	<1	1	160	10	3			
Chaetomium sp.	53	<1	1	ND			ND					
Cladosporium sp.	640	4	12	53	<1	1	587	35	11			
Myxomycetes/Periconia/Smuts	53	<1	1	53	<1	1	107	6	2			
Total Fungal Spores	16852	100	316	16159	100	303	1654	100	31			

ND = None Detected
Results relate only to the items tested and are reported mathematically to significant figures.

Name/Title: ____________________ Name/Title: ____________________

Signature: Reviewed By:

Date: ____________ Date: ____________ Page 1 of 1

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Contact Information

Company: UNYSE | PO#:

Address: 346 Austin Street, Buffalo, NY 14207

Results To: | Fax Results? Y / N | Fax:

Phone: (716) 833-2929 | Email Y / N | Email:

Project Information

Project Name: #141120, 6.B

Sampling Date(s):

Turnaround Time Codes

STD – Standard: 2 Days (Non-viable)
24 – 24: 24 Hours (Non-viable)
R – Rush: 6 hours (Non-viable)
C – Culture: 7-14 Days
W – Weekends: Scheduled by noon ET Friday Only
***Samples received after 5pm, on weekends or in drop-box, will be considered received the next business day.

Requested Services (X Boxes)

Sample ID	Description	Sample Type (Below)	TAT (Above)	Total Volume/Area (as applicable)	Notes: (Time, Temp, Etc.)	Non-Viable – Spore Trap: Fungal Spore Count and Genus ID, pollen, fiber & mycelial fragment count	Non-Viable – Tape Bulk: Fungal Genus Identification – Qualitative	Culturable – Andersen, Swab, Bulk: Environmental Fungal Genus ID & Enumeration	Environmental Bacterial Enumeration & Gram Stain ID	Fungal Speciation – Scheduled in Advance Only	Bacterial speciation – Scheduled in Advance Only
1	#1213745 Bath	Air	24	75L	IWA						
2	#1213742 L.R.	Air	24	75L	IWA						
3	#1213744 Ambient	Air	24	75L	OWA						
	15 L/m @ 5m = 75L.										

Sample Type Codes

AP – Andersen Plate
SW - Swab
B - Bulk
T - Tape
ST - Spore Trap: Zefon, Micro5, Cyclex-d, etc.

Relinquished By	Date & Time	Received By	Date & Time

RECEIVED

By_

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Part 4 Remediation Plan

Re: Mold Assessment Report & Remediation Plan
Lilly Apartments
1313 Mockingbird Lane
Black Rock, NY 14207

This plan has been prepared to meet NYSDOL Regulations

A. Rooms & Areas Where Work Will Be Performed:

Work area shall be defined as Building B, Apt C, entailing the entire unit.

B. Estimated Quantities & Methods for Each Type of Remediation :

- **Ceilings/Walls:** remove all components with surface fungal contamination including non-salvageable drywall, all surfaces within the contained area should then be treated with a fungicide / biocide using disposable cloths and non-metallic brushes. After first clean entire area should be HEPA vacuumed and wiped down again with disposable cloths and a disinfectant solution. After allowing clean surface to dry all areas treated should then be checked for moisture content and visible mold. Living room and bathroom ceilings should be removed where water damage is present 3 ft2 beyond visible water damage. Total estimated living room ceiling removal is 50 ft2. Total estimated bathroom ceiling removal is 75ft2.
- **Shower Surround:** remove all components with surface fungal contamination including non-salvageable drywall, all surfaces within the contained area should then be treated with a fungicide / biocide using disposable cloths and non-metallic brushes. After first clean entire area should be HEPA vacuumed and wiped down again with disposable cloths and a disinfectant solution. After allowing clean surface to dry all areas treated should then be checked for moisture content and visible mold. The tub surround should be removed and disposed. The drywall beneath will be evaluated at that time as to be removed. The tub surround is 30ft2.
- **Carpeting and Furnishings:** remove all components with surface fungal contamination including non-salvageable items. After fist clean entire area should be HEPA vacuumed and wiped down again with disposable cloths and a disinfectant solution. The carpeting and furnishings shall then be steam cleaned twice. The carpeting covers 500ft2
- **Cleaning –** entire dwelling unit shall be cleaned per Disinfectants, Antimicrobials & Coatings (below**).** The dwelling unit comprises 750 ft2.

C. Remediation Methods:

Remediation should be conducted consistent with the New York City Department of Health & Mental Hygiene “Guidelines on Assessment and Remediation of Fungi in

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Indoor Environments", 2008 edition for a **"large area"** and USEPA "Mold Remediation in Schools and Commercial Buildings".

Disinfectants, Antimicrobials & Coatings – Abatement should be completed using appropriate cleaners, disinfectants and coatings, following manufacturer's specifications for application, waiting periods and drying times. All disinfectants, antimicrobials & coatings must registered with the USEPA for their intended use and should be used following the manufacturer's specifications.

The contractor is advised that all horizontal and vertical surfaces require disinfecting and cleaning using an approved fungicide. All hard surfaces should be scrubbed with non-metallic scrub brushes and sealed properly with a fungicidal coating after cleaning is complete and post remedial clearance is achieved.

a) Porous materials:
   i. Remove all visual (active) fungal contamination
   ii. HEPA vacuum transitory fungal accumulation.
   Porous materials are: furnishings, fabric, rugs, carpet, wall board, wall paper, plasters, batten insulation, cellulose insulation, Styrofoam insulation, ceiling tiles, etc.

b) Non-porous materials:
   i. Surface Fungal Contamination -treat in place-wipe down/abrasive treatment, HEPA vacuum, biocide treatment.
   ii. Sub-surface Fungal Contamination (rots)-remove with care relative to structural integrity. Engineering oversight may be required.
   iii. Transitory Fungal Accumulation-HEPA Vacuum, wipe down, biocide treatment.
   Non-porous materials are: wood, plastic, tile, brick, stone, masonry, cement, metal, etc.
   Note: Wood-made surfaces should be inspected for sub-surface structural mold damage and, if found, material should be considered porous and treated accordingly.

c). Air scrubbing technique and HEPA vacuuming of the working and adjacent areas should be performed by the contractor.

d) Salvageable Contents Cleaning should be performed per the following table:

Affected Material or Furnishing	Clean-up Methods*
Books & Papers	3
Carpet & Backing	4
Concrete or Cinder block	2,3
Hard surface, tile, vinyl, linoleum	1,2,3
Plastics & Metals	1,2,3
Toys, Upholstered furniture & drapes	1,2,3,4
Gypsum	2,3,4
Wood	2,3,4

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1. *Method 1: Wet HEPA vacuum, steam cleaning or dry cleaning.
2. Method 2: Biocide
3. Method 3: HEPA vacuum.
4. Method 4: Discard; apply biocide and HEPA vacuum area after biocide is dried

e) Non- Salvageable & adjacent spaces

i. All non-salvageable materials with a mold growth should be disposed
ii. All floors in adjacent non-remediation areas shall be treated as Transitory Fungal Accumulation impacted. HEPA Vacuum and air scrubbing techniques will be used during the remediation.

f) Containment of the work area should be used - Cover the floor, egress pathways, and items left in the work area with plastic sheeting and seal with tape before remediation. Seal ventilation ducts/grills and other openings in the work area with plastic sheeting. Extreme care shall be taken to avoid cross-contamination. Remediated areas shall be sealed from "dirty" areas and air exchange between "clean" and "contaminated" areas shall be controlled.

D. Personal Protective Equipment (PPE) and respiratory protection (e.g., P-100 elastomeric respirator), in accordance with the OSHA respiratory protection standard (*29 CFR 1910.134*), is recommended. Gloves and eye protection should also be worn. Headgear is also required during certain applications (ceiling removal, etc.). The contractor must refer to the MSDS sheets for all cleaners, disinfectants, biocides and sealers used on the project for specific PPE Guidance. PPE shall be required until clearance is achieved. All personal entering the work area are required to provide documentation of certification to the potential hazards associated with exposure to mold and use of Personal Protective Equipment. All activities must be in compliance with NYSDOL's Regulations for the Remediation of Mold and OSHA General Duty Clause.

E. Post Remediation Assessment: Visual inspection for visible accumulation of dust or debris or visible mold and/or air sampling techniques shall be conducted by a NYSDOL Certified Mold Assessment Consultant independent of the firm completing remediation. Presence of dust and debris or visible mold contamination is grounds for additional cleaning. Air samples may be taken for comparison to baseline and control samples. Effective mold remediation involves reducing inside mold levels to less than or equal to typical background. Follow-up evaluation is recommended within first six month upon completion of the mold remediation.

F. Notification & Posting: The work area and areas directly adjacent should be unoccupied. Further vacating of spaces near the work area is recommended including other tradesmen, recent surgical recovery patients, immune-suppressed individuals or inflammatory disease patients during remediation efforts. The work area should be demarcated with appropriate signage and barrier tape and should remain this way until a satisfactory post-remediation clearance assessment is achieved. Signs advising that a mold remediation project is in progress shall be displayed at all accessible entrances to remediation areas.

G. Estimate of Cost & Completion Time:

A typical mold remediation project to remove mold contaminated interior components and disinfect/seal affected/adjacent areas is $2,000-$6,000. If the mold has caused widespread structural damage, repair costs can increase the total to $10,000-$30,000 or more. Considering the size and scope of this project remediation should be completed within seven days and is estimated to cost $5,500.00. Post remediation assessment is estimated to cost an additional $1,500.00.

H. Underlying Causes:

i. A water penetrated roofing system has been identified as the source of water intrusion into the dwelling. This roof failure must be addressed prior to any remediation efforts.

ii. Adequate ventilation to control humidity should be installed in the bathroom to prevent conditions that are ideal for mold amplification

iii. A thorough cleaning should greatly reduce the possibility of airborne mold spores recolonizing in other areas throughout the structure

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Part 5 Photos

Re: Mold Assessment Report & Remediation Plan
1313 Mockingbird Lane
Black Rock, NY 14207

Living room ceiling light fixture

Living room ceiling staining

Mold covered shower curtain and tub surround

Bathroom ceiling

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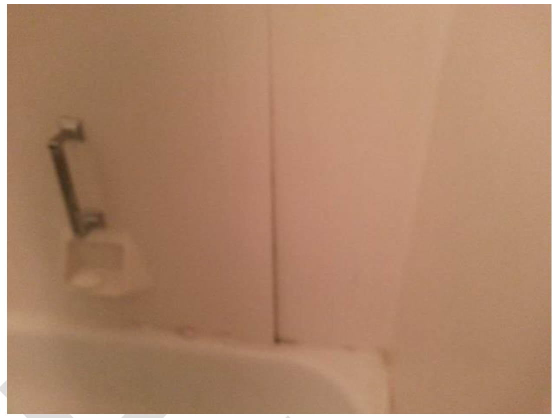
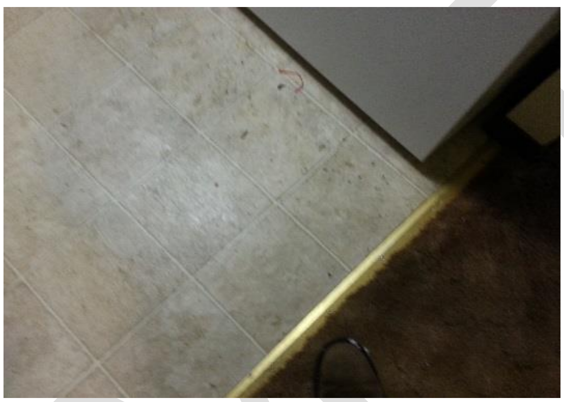
Bath room ceiling

Tub surround



Dirty floor in kitchen



Tyvek suit in garbage can in kitchen

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Part 6 Firm & Staff Credentials

EEA

ENVIRONMENTAL EDUCATION ASSOCIATES

888 4 ENV EDU *environmentaleducation.com*

This certifies that on December 31, 2015

AttendeeFirstName AttendeeLastName

Street Address

City, State Zip Code

Successfully completed the 32 hour NYSDOL accredited:

Mold Assessment Consultant
Initial Certification Training

Pursuant to Article 32, Section 932 of the New York State Labor Law

Certificate Number: MAC-15-1231-01

Course Examination Date:	December 31, 2015
Course Completion Date:	December 31, 2015
Course Expiration Date:	December 31, 2017

Andrew J. McLellan
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Alisa J. Raab
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Part 7 Appendix

Guidelines

on

Assessment and Remediation of Fungi in Indoor Environments

New York City Department of Health and Mental Hygiene

November 2008

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Preface

This 2008 document revises existing guidelines and supersedes all prior editions. It is based both on a review of the current literature regarding fungi (mold) and on comments from a review panel consisting of experts in the fields of mycology/microbiology, environmental health sciences, environmental/occupational medicine, industrial hygiene, and environmental remediation.

These guidelines are intended for use by building owners and managers, environmental contractors and environmental consultants. It is also available for general distribution to anyone concerned about indoor mold growth. The attached fact sheet, "*Mold Growth: Prevention and Cleanup for Building Owners and Managers*," is a simplified summary of these guidelines, which may be useful for building owners, managers and workers. It is strongly recommended that the complete guidelines be referred to before addressing the assessment or remediation of indoor mold growth.

In 1993, the New York City Department of Health and Mental Hygiene (DOHMH) first issued recommendations on addressing mold growth indoors. In 2000, DOHMH made major revisions to the initial guidance and made minor edits in 2002.

The terms *fungi* and *mold* are used interchangeably throughout this document.

This document should be used only as guidance. It is not a substitute for a site-specific assessment and remediation plan and is not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites. Currently there are no United States Federal, New York State, or New York City regulations for the assessment or remediation of mold growth.

These guidelines are available to the public, but may not be reprinted or used for any commercial purpose except with the express written permission of the DOHMH. These guidelines are subject to change as more information regarding this topic becomes available.

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The New York City Department of Health and Mental Hygiene would like to thank the following individuals and organizations for participating in the revision of these guidelines. Please note that these guidelines do not necessarily reflect the opinions of the participants or their organizations.

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Donald Weekes, CIH, CSP	InAIR Environmental Ltd.
Chin Yang, Ph.D.	Prestige EnviroMicrobiology Inc

We would also like to thank the many others who offered opinions, comments, and assistance at various stages during the development of these guidelines.

These guidelines were prepared by the Environmental and Occupational Disease Epidemiology Unit of the New York City Department of Health and Mental Hygiene. This document, and any future revisions, is available online at nyc.gov/health. For further information please call 311 or (212) NEW-YORK (from outside the City). **November 2009**

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Introduction

Fungi (mold) are present almost everywhere. In an indoor environment hundreds of different kinds of mold are able to grow wherever there is moisture and an organic substrate (food source). They can grow on building and other materials, including: the paper on gypsum wallboard (drywall); ceiling tiles; wood products; paint; wallpaper; carpeting; some furnishings; books/papers; clothes; and other fabrics. Mold can also grow on moist, dirty surfaces such as concrete, fiberglass insulation, and ceramic tiles. It is neither possible nor warranted to eliminate the presence of all indoor fungal spores and fragments; however, mold growth indoors can and should be prevented and removed if present.

The purpose of these guidelines is to provide an approach to address potential and observed mold growth on structural materials in commercial, school, and residential buildings. Mold growth in critical care areas of health-care facilities such as intensive care units or surgery suites may pose significant health concerns to patients. This document is not intended for such situations. Please visit the US Centers for Disease Control and Prevention (CDC) at www.cdc.gov for more information on dealing with mold growth and its cleanup in health-care facilities.[1] Mold on bathroom tile grout, in shower stalls, and on bathtubs is a common occurrence. Occupants can control this growth through frequent use of household cleaners.

Water accumulation in indoor environments can lead to mold growth (and other environmental problems), which has been associated with human health effects (see ***Appendix A***).[2-6] Indoor mold growth can be prevented or minimized, however, by actively maintaining, inspecting, and correcting buildings for moisture problems and immediately drying and managing water-damaged materials. In the event that mold growth does occur, this guide is intended to assist those responsible for maintaining facilities in evaluating and correcting this problem.

Removing mold growth and correcting the underlying cause of water accumulation can help to reduce mold exposures and related health symptoms.[7,8] Prompt remediation of mold-damaged materials and infrastructure repair should be the primary response to mold growth in buildings. The simplest, most expedient remediation that properly and safely removes mold growth from buildings should be used. Extensive mold growth poses more difficult problems that should be addressed on a case-by-case basis in consultation with an appropriate building or environmental health professional. In all situations, the source of water must be identified and corrected or the mold growth will recur.

Effective communication with building occupants is an important component of all remedial efforts. Individuals who believe they have mold-related health problems should see their physicians. Individuals who may have an occupationally related illness should be referred to an occupational/environmental physician for evaluation, following any needed initial care. Clinic contact information is available from the New York State Department of Health at www.health.state.ny.us/environmental/workplace/clinic_network.

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Environmental Assessment

The presence of mold growth, water damage, or musty odors should be addressed quickly. In all instances, any sources of water must be identified and corrected and the extent of water damage and any mold growth determined. Water-damaged materials should be removed or cleaned and dried. For additional information on cleaning water-damaged materials and personal belongings, refer to the EPA document "Mold Remediation in Schools and Commercial Buildings."[9]

A trained building or environmental health professional may be helpful in assessing the extent of the moisture problem and mold growth and developing a site-specific work plan. The presence of a trained professional to provide oversight during remediation can also be helpful to ensure quality work and compliance with the work plan. According to the American Industrial Hygiene Association a trained professional should have, at a minimum, a relevant science or engineering degree and two years of full-time supervised experience in mold assessment.[10]

Visual Inspection

A visual inspection is the most important initial step in identifying a possible mold problem and in determining remedial strategies. The extent of any water damage and mold growth should be visually assessed and the affected building materials identified. A visual inspection should also include observations of hidden areas where damages may be present, such as crawl spaces, attics, and behind wallboard. Carpet backing and padding, wallpaper, moldings (*e.g.* baseboards), insulation and other materials that are suspected of hiding mold growth should also be assessed.

Ceiling tiles, paper-covered gypsum wallboard (drywall), structural wood, and other cellulose-containing surfaces should be given careful attention during a visual inspection. Ventilation systems should be visually checked for damp conditions and/or mold growth on system components such as filters, insulation, and coils/fins, as well as for overall cleanliness.

Equipment such as a moisture meter or infrared camera (to detect moisture in building materials) or a borescope (to view spaces in ductwork or behind walls) may be helpful in identifying hidden sources of mold growth, the extent of water damage, and in determining if the water source is active.

Using personal protective equipment such as gloves and respiratory protection (*e.g.* N-95 disposable respirator) should be considered if assessment work might disturb mold. Efforts should also be made to minimize the generation and migration of any dust and mold.

Environmental Sampling

Environmental sampling is **not** usually necessary to proceed with remediation of visually identified mold growth or water-damaged materials. Decisions about appropriate remediation strategies can generally be made on the basis of a thorough visual inspection. Environmental sampling may be helpful in some cases, such as, to confirm the presence of visually identified

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mold or if the source of perceived indoor mold growth cannot be visually identified.

If environmental samples will be collected, a sampling plan should be developed that includes a clear purpose, sampling strategy, and addresses the interpretation of results. [11,12] Many types of sampling can be performed (*e.g.* air, surface, dust, and bulk materials) on a variety of fungal components and metabolites, using diverse sampling methodologies. Sampling methods for fungi are not well standardized, however, and may yield highly variable results that can be difficult to interpret.[11-17] Currently, there are no standards, or clear and widely accepted guidelines with which to compare results for health or environmental assessments.

Environmental sampling should be conducted by an individual who is trained in the appropriate sampling methods and is aware of the limitations of the methods used. Using a laboratory that specializes in environmental mycology is also recommended. The laboratory should be accredited in microbiology by an independent and reputable certifying organization.

For additional information on sampling, refer to the American Conference of Governmental Industrial Hygienists' publication, "Bioaerosols: Assessment and Control" and the American Industrial Hygiene Association's " Field Guide for the Determination of Biological Contaminants in Environmental Samples."[11,18]

Remediation

The goal of remediation is to remove or clean mold-damaged materials using work practices that protect occupants by controlling the dispersion of mold from the work area and protect remediation workers from exposures to mold. The listed remediation methods were designed to achieve this goal; however, they are not meant to exclude other similarly effective methods and are not a substitute for a site-specific work plan. Since little scientific information exists that evaluates the effectiveness and best practices for mold remediation, these guidelines are based on principles used to remediate common indoor environmental hazards. These guidelines are not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites.

Prior to any remediation, consideration must be given to the potential presence of other environmental hazards, such as asbestos and lead. These guidelines are based on possible health risks from mold exposure and may be superseded by standard procedures for the remediation of other indoor environmental hazards.

Moisture Control and Building Repair

In all situations, the underlying moisture problem must be corrected to prevent recurring mold growth. Indoor moisture can result from numerous causes, such as: façade and roof leaks; plumbing leaks; floods; condensation; and high relative humidity. An appropriate building expert may be needed to identify and repair building problems. An immediate response

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and thorough cleaning, drying, and/or removal of water-damaged materials will prevent or limit microbial growth.

Relative humidity should generally be maintained at levels below 65% to inhibit mold growth.[19] Short-term periods of higher humidity would not be expected to result in mold growth.[20] However, condensation on cold surfaces could result in water accumulation at much lower relative humidity levels. Relative humidity should be kept low enough to prevent condensation on windows and other surfaces.

Emphasis should be placed on ensuring proper repairs of the building infrastructure so that water intrusion and moisture accumulation is stopped and does not recur.

Worker Training

Proper training of workers is critical in successfully and safely remediating mold growth.[21,22] Training topics that should be addressed include:

- Causes of moisture intrusion and mold growth
- Health concerns related to mold exposure
- The use of appropriate personal protective equipment
- Mold remediation work practices, procedures, and methods

For additional information, the National Institute of Environmental Health Sciences' publication, "Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold" lists minimum training criteria for building maintenance and mold remediation workers that should be completed before addressing indoor mold growth.[23]

Trained building maintenance staff can address limited and occasional mold growth. For larger jobs, more extensively trained mold remediation workers may be needed.

Cleaning Methods

Non-porous materials (*e.g.* metals, glass, and hard plastics) can almost always be cleaned. Semi-porous and porous structural materials, such as wood and concrete can be cleaned if they are structurally sound. Porous materials, such as ceiling tiles and insulation, and wallboards (with more than a small area of mold growth) should be removed and discarded. Wallboard should be cleaned or removed at least six inches beyond visually assessed mold growth (including hidden areas, see ***Visual Inspection***) or wet or water-damaged areas.[24] A professional restoration consultant should be contacted to restore valuable items that have been damaged.

Cleaning should be done using a soap or detergent solution. Use the gentlest cleaning method that effectively removes the mold to limit dust generation. All materials to be reused should be dry and visibly free from mold. Consideration should also be given to cleaning surfaces and materials adjacent to areas of mold growth for settled spores and fungal fragments. A vacuum

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equipped with a High-Efficiency Particulate Air (HEPA) filter could also be used to clean these adjacent areas.

Disinfectants are seldom needed to perform an effective remediation because removal of fungal growth remains the most effective way to prevent exposure. Disinfectant use is recommended when addressing certain specific concerns such as mold growth resulting from sewage waters. If disinfectants are considered necessary, additional measures to protect workers and occupants may also be required. Disinfectants must be registered for use by the United States Environmental Protection Agency (EPA). Any antimicrobial products used in a HVAC system must be EPA-registered specifically for that use.

The use of gaseous, vapor-phase, or aerosolized (*e.g.* fogging) biocides for remedial purposes is **not** recommended. Using biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold.

Quality Assurance Indicators

Measures to ensure the quality and effectiveness of remediation should be undertaken regardless of the project size. Evaluations *during* as well as *after* remediation should be conducted to confirm the effectiveness of remedial work, particularly for large-scale remediation. At minimum, these quality assurance indicators should be followed and documented:

- The underlying moisture problem was identified and eliminated
- Isolation of the work area was appropriate and effective
- Mold removal and worksite cleanup was performed according to the site-specific plan
- Any additional moisture or mold damage discovered during remediation was properly addressed
- Upon completion of remediation, surfaces are free from visible dust and debris.
- If environmental sampling was performed, the results of such sampling were evaluated by a trained building or environmental health professional.[10]

Restoring Treated Spaces

After completing mold remediation and correcting moisture problems, building materials that were removed should be replaced and brought to an intact and finished condition. The use of new building materials that do not promote mold growth should be considered. Anti-microbial paints are usually unnecessary after proper mold remediation. They should not be used in lieu of mold removal and proper moisture control, but may be useful in areas that are reasonably expected to be subject to moisture.

Remediation Procedures

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Three different sizes of remediation and the remediation of heating, ventilation, and air-conditioning (HVAC) systems are described below. Currently, existing research does not relate the amount of mold growth to the frequency or severity of health effects. However, as the presence of moldy materials increases, so does the potential for exposure[8] and the need to limit the spread of mold-containing dusts and worker exposures. As such, the size of the area impacted by mold growth as well as practical considerations were used to help define remedial procedures.

Since the following areas were arbitrarily selected, site-specific conditions must be considered in choosing adequate remediation procedures. For more information on the unique characteristics of building types and occupancies that may influence remediation procedures refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[25]

Small Isolated Areas (less than 10 square feet) – *e.g.* ceiling tiles, small areas on walls

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) If work may impact difficult-to-clean surfaces or items (e.g. carpeting, electronic equipment), the floor of the work area, egress pathways, and other identified materials/belongings should be removed or covered with plastic sheeting and sealed with tape before remediation.

(e) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in a sealed plastic bag(s). Plastic sheeting should be discarded after use. There are no special requirements for the disposal of moldy materials.

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

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Medium-Sized Isolated Areas (10 – 100 square feet)

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) Cover the floor, egress pathways, and items left in the work area with plastic sheeting and seal with tape before remediation.

(e) Seal ventilation ducts/grills and other openings in the work area with plastic sheeting. The HVAC system servicing this area may need to be shut down to properly seal vents.

(f) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(g) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in sealed plastic bags. Plastic sheeting should be discarded after use. There are no special requirements for disposal of moldy materials.

(h) The work area and areas used by workers for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution.

(i) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

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Large Areas (greater than 100 square feet in a contiguous area) – *e.g.* on separate walls in a single room

Properly trained and equipped mold remediation workers should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) to provide oversight during remediation may be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

(b) Containment of the affected area:

i. The HVAC system servicing this area should be shut down during remediation.
ii. Isolation of the work area using plastic sheeting sealed with duct tape. Furnishings should be removed from the area. Ventilation ducts/grills, any other openings, and remaining fixtures/furnishings should be covered with plastic sheeting sealed with duct tape.
iii. Consider using an exhaust fan equipped with a HEPA filter to generate negative pressurization.
iv. Consider using airlocks and a clean changing room.
v. Egress pathways should also be covered if a clean changing room is not used.

(c) The work area should be unoccupied.

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) Moldy materials, that can be cleaned, should be cleaned using a soap or detergent solution. 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 soap or detergent solution or HEPA-vacuumed in the work area (or clean changing room) prior to their transport to unaffected areas of the building. There are no special requirements for the disposal of moldy materials.

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(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dusts outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop with a soap or detergent solution and be visibly clean prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Remediation of HVAC Systems

Mold growth in heating, ventilation, and air-conditioning (HVAC) systems can pose building-wide problems. Obtaining professional help should always be considered in addressing even small amounts of mold growth or moisture problems within an HVAC system. Recurring problems, regardless of size, may indicate a systemic problem and appropriate professional help should be sought.

Small Isolated Area of Mold Growth in the HVAC System (<10 square feet) – *e.g.* box filter, small area on insulation

(a) Remediation can be conducted by trained building maintenance staff that are familiar with the design and function of the impacted HVAC system. Such persons should receive training on proper cleaning 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.* N-95 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) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) The use of plastic sheeting to isolate other sections of the system should be considered.

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(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed and sealed in plastic bags. There are no special requirements for the disposal of moldy materials.

(g) The work area and areas used for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution. Any plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Large Area of Mold Growth in the HVAC System (>10 square feet)

Properly trained and equipped mold remediation workers with specific training and experience in HVAC systems, should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) with experience and specific knowledge of HVAC systems, to provide oversight during remediation can be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

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

(c) Containment of the affected area:

i. 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 equipped with a HEPA filter to generate negative pressurization should be considered
iii. Consider using airlocks and a clean changing room
iv. Egress pathways should also be covered if a clean changing room is not used

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that

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create excessive dust should be avoided.

(e) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a soap or detergent solution or HEPA-vacuumed prior to their removal from the isolated work area. There are no special requirements for the disposal of moldy materials.

(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dust outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Communication with Building Occupants

Communication with occupants of affected spaces is important regardless of the size of the project but is especially important when mold growth requiring large-scale remediation is found. When large-scale remediation is performed, the building owner, management, and/or employer should notify occupants in the building. 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. Building occupants should be provided with a copy of all inspection reports upon request. For more detailed information on risk communication refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[26]

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Appendix A

Health Effects

Several comprehensive reviews of the scientific literature on the health effects of mold in indoor spaces have been published in recent years.[1-3] This appendix reflects these reviews but has also considered more recently published articles.

Potential for Exposure and Health Effects

Fungi are common in both indoor and outdoor environments and play a vital role in the earth's ecology by decomposing organic matter such as dead trees and leaves. As a result, all people have routine exposure to fungi, which may occur through inhalation, ingestion, and touching moldy surfaces. The main route of exposure to mold for people living or working in moldy indoor environments is inhalation of airborne fungal spores, fragments, or metabolites.[2] Ingestion and dermal exposures are less understood in these scenarios and can easily be minimized or prevented by workers through proper hygiene and work practices. Therefore, the remaining discussion will focus on the adverse health effects of mold due to inhalational exposure.

Adverse health effects may include: allergic reactions; toxic effects and irritation; and infections.[1-5] The mere presence of mold growth does not necessarily indicate that people present in the area will exhibit adverse health effects. However, as the amount of mold-impacted materials increases, so do potential exposures. Certain exposures may represent a significant risk such as occupational exposures to high concentrations of fungi and chronic (long-term) exposures, especially of individuals with underlying health conditions such as asthma, compromised immune systems, or allergies.

Evidence linking mold exposures to severe human health effects is documented in reports of occupational disease, particularly in forestry and agricultural settings where inhalation exposures were typically high and/or chronic.[2,6-11] The intensity of mold exposure and associated health effects experienced in undisturbed indoor environments is usually much less severe than that experienced by agricultural or forestry workers.[2,7,12-14] With the possible exception of exposures from mold remediation work, such high-level exposures are not expected indoors.[15-16] Although high-level exposures are unlikely to occur in undisturbed indoor settings, chronic exposures to lower levels may still raise health concerns.

Several factors influence the likelihood that individuals might experience health effects following exposure to mold in indoor environments. These include: the nature of the fungal material (e.g., allergenic, toxic/irritant, or infectious); the degree of exposure (amount and duration); and the susceptibility of exposed people. Susceptibility varies with genetic predisposition, age, state of health, concurrent exposures, and previous sensitization. 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.[17]

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In addition to the adverse health effects associated with exposure to mold, in 2004, the Institute of Medicine (IOM) reported health risks associated with living in damp indoor environments. The IOM reported evidence suggesting an association between damp indoor environments and the development of asthma. Reported respiratory symptoms included, wheezing, coughing, and exacerbation of asthma.[2]

Allergic and Hypersensitivity Effects

It is well established that fungi can cause allergic reactions in humans. The most common symptoms associated with allergic reactions include runny nose, sneezing, post-nasal drip with sore throat, eye irritation, cough, wheeze, and other symptoms associated with the aggravation of asthma.[2,13,18-23] Immunological responses to mold include allergic rhinitis, hypersensitivity pneumonitis, and asthma exacerbations. These conditions require prior exposure for sensitization. These symptoms may persist for some time after removal from the source.

Allergic rhinitis is a group of symptoms that mostly affects the mucous membranes of nasal passages and may result from an allergic reaction to fungi. Symptoms often associated with "hay fever" such as congestion, runny nose, and sneezing may occur.[5,24]

Hypersensitivity pneumonitis (HP) is a rare lung disease with delayed onset (3-8 hours) of fever, shortness of breath, cough, chest tightness, chills, and general malaise. With continued exposure, HP can lead to permanent lung disease. The occurrence of HP, even among those that are highly exposed to fungi, is rare. HP has typically been associated with repeated heavy exposures in forestry and agricultural settings, which raises concerns for workers routinely performing mold remediation, but has also been reported in indoor settings with lower level chronic exposures.[3,11,18,25-27]

Allergic bronchopulmonary aspergillosis (ABPA) and allergic fungal sinusitis (AFS) are examples of rarely occurring allergic reactions to non-invasive fungal growth in the respiratory system. Most symptoms are non-specific resembling asthma or chronic sinusitis. In addition, ABPA and AFS usually occur in those with underlying medical problems. In the case of ABPA, this includes cystic fibrosis, asthma, and other predisposing medical conditions.[28,29]

Recent studies, which have suggested an association between the presence of indoor mold and the development of asthma or allergies, are limited and difficult to interpret. Stark *et al.* found higher concentrations of dust-borne mold in infants' homes were associated with development of allergic rhinitis, which is a known risk factor for childhood asthma.[24] However, other studies have shown higher concentrations of dust-borne fungi and other microorganisms in infants' homes were associated with a *decreased* risk for asthma and wheezing.[30,31] Jaakkola et al. reported an association between a moldy odor in the home and development of asthma, but no association with visible mold or water damage was found. Although the sample size for this subset was small, it suggests that active mold growth might be a stronger risk factor for certain health effects than presence of nonviable or inactive mold alone.[32] This also is supported by recent studies that have shown allergen production is significantly increased during active growth.[33,34]

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Though available, allergy testing for molds is limited, subject to high rates of error, and can be difficult to interpret. Preparations for skin testing or the specific antigen in blood tests may be different from the mold to which an individual is sensitive. A positive test indicates an allergic response but does not definitively link a specific mold exposure to an individual's current health condition.[5]

Irritant and Toxic Effects

Irritant Effects

Indoor growth of mold can lead to the production of volatile organic compounds (VOCs), also referred to as microbial VOCs (MVOCs), and the presence of fungal glucans.[13,35-38] Glucans are components of many fungal cell walls. Some studies have reported an association with the inhalation of glucans and airway irritation and inflammation, but results have been mixed and may not be applicable to expected indoor concentrations. Observed effects may also be the result of exposure to or contact with other fungal components, metabolites, or synergistic effects with other microbial agents.[17,36,39] Resolution of irritant symptoms upon removal from the source can help distinguish irritant effects from allergic symptoms.[5]

MVOCs are responsible for the musty odor often associated with mold growth, which may be noticeable at very low concentrations. Many of the MVOCs are common to other sources in the home.[40] The very low levels usually found indoors have not been shown to cause health effects.[35,37]

Toxic Effects

Some symptoms and maladies have been attributed to the toxic effects of fungi in indoor environments. Certain fungi can produce toxins (mycotoxins) at varying levels that are dependent on many complex environmental and biological factors.[41] The reported symptoms from exposure to mycotoxins indoors include headaches, irritation, and nausea/loss of appetite, but are often non-specific (*e.g.* fatigue, inability to concentrate/remember), and may be caused by other environmental and non-environmental agents.[2,42-46] Although health effects from exposures to mycotoxins have been associated with certain occupational exposures or ingestion of mold-contaminated food, scientific support for the reported effects in indoor environments has not been established. This may be due to the lower levels of exposure and different routes of exposure.[2,5,13,21,27,46-49]

Stachybotrys is colloquially referred to as "black mold" or "toxic mold." It has been suggested that toxins produced by this mold are associated with specific health effects. Acute Idiopathic Pulmonary Hemorrhage (AIPH) in infants has been described in several reports suggesting a relationship with *Stachybotrys*. AIPH is an uncommon condition that results in bleeding in the lungs. The IOM reviewed the existing studies and concluded that there was insufficient evidence to determine if mold exposure was associated with AIPH.[2,3] The evidence is also insufficient for an association between inhalation of *Stachybotrys* toxins indoors and neurological damage.[2,26,49] Although severe health effects from the inhalation exposures to

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Stachybotrys toxins indoors is plausible, it is not well-supported, and the issue remains controversial.[2,3,5,27,49,50]

Organic dust toxic syndrome (ODTS) describes the abrupt onset of fever, flu-like symptoms, and respiratory symptoms in the hours following a single, heavy exposure to dust-containing fungi and other microorganisms. Unlike HP, ODTS does not require repeated exposures to bioaerosols and can occur after the first exposure. ODTS has been documented in farm workers handling contaminated material, but may also affect workers performing remediation of building materials with widespread mold growth.[2,11,27] ODTS is a self-limited illness, which usually improves within 24 hours after the discontinuation of exposure. It may be underreported among workers exposed to fungi, but would not be expected in occupants of buildings with mold growth.[11,27]

Infectious Disease

Only a small number of fungi have been associated with infectious disease. Few of these fungi are typically found in the indoor environment.[51,52] Several species of *Aspergillus* are known to cause aspergillosis, most commonly *A. fumigatus*, *A. flavus,* and rarely, other species. Aspergillosis is a disease that generally affects severely immunosuppressed persons. Exposure to these molds, even in high concentrations, is unlikely to cause infection in healthy individuals.[21,53] Heavy 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. More severe health effects are primarily encountered in immunocompromised persons.[18,54]

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Example Mold Remediation Work Plan

Contractor Name: ______________________________
Address: ______________________________

Location: Lilly Apartments
Building B, Apt C
1313 Mockingbird Lane
Black Rock, NY

This plan has been prepared by the Remediation Contractor to comply with New York State Labor Law Article 32 and shall be provided to client before site preparation work begins.

1. **Description of Work:** This project will entail the following mold abatement measures:

- **Ceilings/Walls:** remove all components with surface fungal contamination including non-salvageable drywall, all surfaces within the contained area will then be treated with a fungicide / biocide using disposable cloths and non-metallic brushes. After first clean entire area will be HEPA vacuumed and wiped down again with disposable cloths and a disinfectant solution. After allowing clean surface to dry all areas treated will then be checked for moisture content and visible mold. Living room and bathroom ceilings will be removed where water damage is present 3 ft^2 beyond visible water damage. Total estimated living room ceiling removal is 50 ft^2. Total estimated bathroom ceiling removal is $75ft^2$.
- **Shower Surround:** remove all components with surface fungal contamination including non-salvageable drywall, all surfaces within the contained area will then be treated with a fungicide / biocide using disposable cloths and non-metallic brushes. After first clean entire area will be HEPA vacuumed and wiped down again with disposable cloths and a disinfectant solution. After allowing clean surface to dry all areas treated will then be checked for moisture content and visible mold. The tub surround will be removed and disposed. The drywall beneath will be evaluated at that time as to be removed. The tub surround is $30ft^2$.
- **Carpeting and Furnishings:** remove all components with surface fungal contamination including non-salvageable items. After fist clean entire area will be HEPA vacuumed and wiped down again with disposable cloths and a disinfectant solution. The carpeting and furnishings shall then be steam cleaned twice. The carpeting covers $500ft^2$
- **Cleaning –** entire dwelling unit shall be cleaned per Disinfectants, Antimicrobials & Coatings (below**).** The dwelling unit comprises 750 ft^2.

2. **Personal Protective Equipment**

(PPE) and respiratory protection (e.g., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection will also be worn. Headgear is also required during certain applications (ceiling removal, etc.). PPE shall be required until clearance is achieved. All personnel entering the work area are required to provide documentation of certification to the potential hazards associated with exposure to mold and use of Personal Protective Equipment. All activities must be in compliance with New York State Labor Law Article 32, OSHA “A Brief Guide to Mold in The Workplace”, 2013 update and the OSHA General Duty Clause.

3. Standard Operating Procedures:

a. Occupant notification will be conducted per the remediation plan. Work area and areas directly adjacent will be unoccupied and posted with appropriate signage and barrier tape and will remain this way until a satisfactory post-remediation clearance assessment is achieved. Signs advising that a mold remediation project is in progress and only authorized personnel shall enter will be displayed at all accessible entrances to remediation areas.

b. Remediation will be conducted consistent with the New York City Department of Health & Mental Hygiene “Guidelines on Assessment and Remediation of Fungi in Indoor Environments”, 2008 edition for a “large area” and USEPA “Mold Remediation in Schools and Commercial Buildings”.

c. Containment of the affected area will be prepared per NYC Guidelines:

1) The HVAC system servicing this area will be shut down during remediation.
2) A personal decontamination facility, comprised of an airlock and changing room will be attached to the work area and serve as the primary egress to the work area.
3) Isolation of the work area shall be accomplished using plastic sheeting sealed with duct tape.
4) Ventilation ducts/grills, any other openings, and remaining fixtures/furnishings will be covered with plastic sheeting sealed with duct tape.
5) Install an exhaust fan equipped with a HEPA filter to generate negative pressurization.

d. Efforts will be made to reduce dust generation, including:
1) cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal;
2) Use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; using a vacuum equipped with a HEPA filter at the point of dust generation.
3) Work practices that create excessive dust will be avoided.

e. Cleaning
1) Before leaving isolated areas, workers will remove disposable clothing to prevent the tracking of mold-containing dusts outside of the work area.
2) The work area and egress pathways (and clean changing room if present) will be HEPA-vacuumed and cleaned with a damp cloth and/or mop with a soap or detergent solution and be visibly clean prior to the removal of isolation barriers. Plastic sheeting will be discarded after use.
3) All areas will be left dry and visibly free from mold, dust, and debris.

f. Disinfectants, Antimicrobials & Coatings - The intended disinfectant is Foster 40/80. The intended antimicrobial coating is Foster 40/80. This product is registered with the USEPA for its intended use and will be used following the manufacturer’s specifications.

g. All hard surfaces will be scrubbed with non-metallic scrub brushes and sealed properly with a fungicidal coating after cleaning is complete and post remedial clearance is achieved.
1) Porous materials:

i. Remove all visual (active) fungal contamination
ii. HEPA vacuum transitory fungal accumulation.

2) Non-porous materials:
   i. Surface Fungal Contamination -treat in place-wipe down/abrasive treatment, HEPA vacuum, biocide treatment.
   ii. Sub-surface Fungal Contamination (rots)-remove with care relative to structural integrity. Engineering oversight may be required.
   iii. Transitory Fungal Accumulation-HEPA Vacuum, wipe down, biocide treatment.

3) Salvageable Contents Cleaning will be performed per the following table:

Affected Material or Furnishing	Clean-up Methods*
Books & Papers	3
Carpet & Backing	4
Concrete or Cinder block	2,3
Hard surface, tile, vinyl, linoleum	1,2,3
Plastics & Metals	1,2,3
Toys, Upholstered furniture & drapes	1,2,3,4
Gypsum	2,3,4
Wood	2,3,4

1. *Method 1: Wet HEPA vacuum, steam cleaning or dry cleaning.
2. Method 2: Biocide
3. Method 3: HEPA vacuum.
4. Method 4: Discard; apply biocide and HEPA vacuum area after biocide is dried

h. Non- Salvageable & adjacent spaces
   i. All non-salvageable materials with a mold growth will be disposed
   ii. All floors in adjacent non-remediation areas will be treated as Transitory Fungal Accumulation impacted. HEPA Vacuum and air scrubbing techniques will be used during the remediation.

i. Disposal

All mold contaminated waste, including plastic sheeting and disposable clothing, shall be containerized in 6 mil contractor bags, removed from the premises daily and disposed per applicable regulations to an unclean place outside of town.

Prepared By: ______________________________

Date Prepared: ______________________________

NYSDOL License #: ______________________________

Signature: ______________________________

Date provided to Client: ________________________

Form of Transmittal: ________________________
e.g. certified mail, hand delivered:

EEA ENVIRONMENTAL EDUCATION ASSOCIATES
environmentaleducation.com

Model Remediation Plan

Date: ______________

Re: Title
Location
Address
City, State, Zip

This plan has been prepared by the Mold Assessor to comply with New York State Labor Law Article 32 and shall be provided to client before site preparation work begins.

Prepared By: ______________________________
Date Prepared: ______________________________
NYSDOL License #: ______________________________

Signature: ______________________________

Date provided to Client: ________________________
Form of Transmittal: ________________________
e.g. certified mail, hand delivered

Table of Contents

A. Remediation Plan Summary

This mold remediation report has been prepared by ___________, based on mold assessment services conducted __________. Mold assessment indicated mold contamination at the following locations.

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B. Rooms & Areas Where Work Will Be Performed:

C. Estimated Quantities & Methods for Each Type of Remediation :

D. Remediation Methods:

E. Disinfectants, Antimicrobials & Coatings - The recommended disinfectant is _________. The recommended antimicrobial coating is ________. This product is/is not registered with the USEPA for its intended use and should be used following the manufacturer's specifications.

The contractor is advised that all horizontal and vertical surfaces require disinfecting and cleaning using an approved fungicide. All hard surfaces should be scrubbed with non-metallic scrub brushes and sealed properly with a fungicidal coating after cleaning is complete and post remedial clearance is achieved.

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a) Porous materials:
   i. Remove all visual (active) fungal contamination
   ii. HEPA vacuum transitory fungal accumulation.

   Porous materials are: furnishings, fabric, rugs, carpet, wall board, wall paper, plasters, batten insulation, cellulose insulation, Styrofoam insulation, ceiling tiles, etc.

b) Non-porous materials:
   i. Surface Fungal Contamination -treat in place-wipe down/abrasive treatment, HEPA vacuum, biocide treatment.
   ii. Sub-surface Fungal Contamination (rots)-remove with care relative to structural integrity. Engineering oversight may be required.
   iii. Transitory Fungal Accumulation-HEPA Vacuum, wipe down, biocide treatment.

   Non-porous materials are: wood, plastic, tile, brick, stone, masonry, cement, metal, etc.

   Note: Wood-made surfaces should be inspected for sub-surface structural mold damage and, if found, material should be considered porous and treated accordingly.

c). Air scrubbing technique and HEPA vacuuming of the working and adjacent areas should be performed by the contractor.

d) Salvageable Contents Cleaning should be performed per the following table:

Affected Material or Furnishing	Clean-up Methods*
Books & Papers	3
Carpet & Backing	4
Concrete or Cinder block	2,3
Hard surface, tile, vinyl, linoleum	1,2,3
Plastics & Metals	1,2,3
Toys, Upholstered furniture & drapes	1,2,3,4
Gypsum	2,3,4
Wood	2,3,4

1. *Method 1: Wet HEPA vacuum, steam cleaning or dry cleaning.
2. Method 2: Biocide
3. Method 3: HEPA vacuum.
4. Method 4: Discard; apply biocide and HEPA vacuum area after biocide is dried

e) Non- Salvageable & adjacent spaces
   i. All non-salvageable materials with a mold growth should be disposed
   ii. All floors in adjacent non-remediation areas shall be treated as Transitory Fungal Accumulation impacted. HEPA Vacuum and air scrubbing techniques will be used during the remediation.

f) Containment of the work area should be used - Cover the floor, egress pathways, and items left in the work area with plastic sheeting and seal with tape before remediation. Seal ventilation ducts/grills and other openings in the work area with plastic sheeting. Extreme care shall be taken to avoid cross-contamination. Remediated

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areas shall be sealed from “dirty” areas and air exchange between “clean” and “contaminated” areas shall be controlled.

F. Personal Protective Equipment (PPE) and respiratory protection (e.g., _______ respirator), in accordance with the OSHA respiratory protection standard (*29 CFR 1910.134*), is recommended. Gloves and eye protection should also be worn. Headgear is also required during certain applications (ceiling removal, etc.). The contractor must refer to the MSDS sheets for all Biocide / Fungicides used on the project for specific PPE Guidance. PPE shall be required until clearance is achieved. All personal entering the work area are required to provide documentation of certification to the potential hazards associated with exposure to mold and use of Personal Protective Equipment. All activities must be in compliance with NYSDOL’s Regulations for the Remediation of Mold and OSHA General Duty Clause.

G. Post Remediation Assessment: Visual inspection for visible accumulation of dust or debris or visible mold and/or air sampling techniques shall be conducted by a NYSDOL Certified Mold Assessment Consultant independent of the firm completing remediation. Presence of dust and debris or visible mold contamination is grounds for additional cleaning. Air samples may be taken for comparison to baseline and control samples. Effective mold remediation involves reducing inside mold levels to less than or equal to typical background. Follow-up evaluation is recommended within first six month upon completion of the mold remediation.

H. Notification & Posting: The work area and areas directly adjacent should be unoccupied. Further vacating of spaces near the work area is recommended including other tradesmen, recent surgical recovery patients, immune-suppressed individuals or inflammatory disease patients during remediation efforts. The work area should be demarcated with appropriate signage and barrier tape and should remain this way until a satisfactory post-remediation clearance assessment is achieved. Signs advising that a mold remediation project is in progress shall be displayed at all accessible entrances to remediation areas.

I. Estimate of Cost & Completion Time:
A typical mold remediation project to remove mold contaminated interior components and disinfect/seal affected/adjacent areas is $________. If the mold has caused widespread structural damage, repair costs can increase the total to $________. Considering the size and scope of this project remediation should be completed within _______days and is estimated to cost $________. Post remediation assessment is estimated to cost an additional $_______.

J. Underlying causes:

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K. Photos

Photo #1

Photo #2

Photo #3

Photo #4

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L. Assessor Credentials

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TRAINING PROVIDER ID MTP-002

Certificate of Completion

This certifies that on **<insert Course Completion Date>**

<Attendee Name>

DMV License Number :<Attendee DMV ID>

Successfully completed the **32** *hour New York State Department of Labor – approved*

Mold Assessor Initial Course

Pursuant to Article 32 of the New York State Labor Law

Attendee Identification Number: <Course ID> – <Year> – <Month> – <Day> – <Provider ID> – <Attendee #>

Training Course Location: <City, State>

Andrew J. McLellan, Training Director

This certificate is not a license to perform assessment, remediation or abatement of mold projects.

M. Appendix – NYC Guidelines

Guidelines

on

Assessment and Remediation of Fungi in Indoor Environments

New York City Department of Health and Mental Hygiene

November 2008

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Preface

This 2008 document revises existing guidelines and supersedes all prior editions. It is based both on a review of the current literature regarding fungi (mold) and on comments from a review panel consisting of experts in the fields of mycology/microbiology, environmental health sciences, environmental/occupational medicine, industrial hygiene, and environmental remediation.

These guidelines are intended for use by building owners and managers, environmental contractors and environmental consultants. It is also available for general distribution to anyone concerned about indoor mold growth. The attached fact sheet, "*Mold Growth: Prevention and Cleanup for Building Owners and Managers*," is a simplified summary of these guidelines, which may be useful for building owners, managers and workers. It is strongly recommended that the complete guidelines be referred to before addressing the assessment or remediation of indoor mold growth.

In 1993, the New York City Department of Health and Mental Hygiene (DOHMH) first issued recommendations on addressing mold growth indoors. In 2000, DOHMH made major revisions to the initial guidance and made minor edits in 2002.

The terms *fungi* and *mold* are used interchangeably throughout this document.

This document should be used only as guidance. It is not a substitute for a site-specific assessment and remediation plan and is not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites. Currently there are no United States Federal, New York State, or New York City regulations for the assessment or remediation of mold growth.

These guidelines are available to the public, but may not be reprinted or used for any commercial purpose except with the express written permission of the DOHMH. These guidelines are subject to change as more information regarding this topic becomes available.

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The New York City Department of Health and Mental Hygiene would like to thank the following individuals and organizations for participating in the revision of these guidelines. Please note that these guidelines do not necessarily reflect the opinions of the participants or their organizations.

Donald Ahearn, PhD	Georgia State University
Scott Armour, MS	Armour Applied Science LLC
John Banta, CAIH	Restoration Consultants
Don Bremner	Environmental Abatement Council of Ontario – Restoration Environmental Contractors
Terry Brennan, MS	Camroden Associates Inc.
Armando Chamorro, CIH	CIH Environmental
Ginger Chew, ScD	Columbia University
Sidney Crow, PhD	Georgia State University
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Dorr Dearborn, MD	Rainbow Childrens Hospital
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Eric Esswein, MPH, CIH	US National Institute for Occupational Safety and Health
Elissa Favata, MD	Environmental and Occupational Health Associates
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John Tancredi	Environmental Contractors Association of New York City – Pinnacle Environmental Corp.
Donald Weekes, CIH, CSP	InAIR Environmental Ltd.
Chin Yang, Ph.D.	Prestige EnviroMicrobiology Inc

We would also like to thank the many others who offered opinions, comments, and assistance at various stages during the development of these guidelines.

These guidelines were prepared by the Environmental and Occupational Disease Epidemiology Unit of the New York City Department of Health and Mental Hygiene. This document, and any future revisions, is available online at nyc.gov/health. For further information please call 311 or (212) NEW-YORK (from outside the City).

November 2009

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Introduction

Fungi (mold) are present almost everywhere. In an indoor environment hundreds of different kinds of mold are able to grow wherever there is moisture and an organic substrate (food source). They can grow on building and other materials, including: the paper on gypsum wallboard (drywall); ceiling tiles; wood products; paint; wallpaper; carpeting; some furnishings; books/papers; clothes; and other fabrics. Mold can also grow on moist, dirty surfaces such as concrete, fiberglass insulation, and ceramic tiles. It is neither possible nor warranted to eliminate the presence of all indoor fungal spores and fragments; however, mold growth indoors can and should be prevented and removed if present.

The purpose of these guidelines is to provide an approach to address potential and observed mold growth on structural materials in commercial, school, and residential buildings. Mold growth in critical care areas of health-care facilities such as intensive care units or surgery suites may pose significant health concerns to patients. This document is not intended for such situations. Please visit the US Centers for Disease Control and Prevention (CDC) at www.cdc.gov for more information on dealing with mold growth and its cleanup in health-care facilities.[1] Mold on bathroom tile grout, in shower stalls, and on bathtubs is a common occurrence. Occupants can control this growth through frequent use of household cleaners.

Water accumulation in indoor environments can lead to mold growth (and other environmental problems), which has been associated with human health effects (see ***Appendix A***).[2-6] Indoor mold growth can be prevented or minimized, however, by actively maintaining, inspecting, and correcting buildings for moisture problems and immediately drying and managing water-damaged materials. In the event that mold growth does occur, this guide is intended to assist those responsible for maintaining facilities in evaluating and correcting this problem.

Removing mold growth and correcting the underlying cause of water accumulation can help to reduce mold exposures and related health symptoms.[7,8] Prompt remediation of mold-damaged materials and infrastructure repair should be the primary response to mold growth in buildings. The simplest, most expedient remediation that properly and safely removes mold growth from buildings should be used. Extensive mold growth poses more difficult problems that should be addressed on a case-by-case basis in consultation with an appropriate building or environmental health professional. In all situations, the source of water must be identified and corrected or the mold growth will recur.

Effective communication with building occupants is an important component of all remedial efforts. Individuals who believe they have mold-related health problems should see their physicians. Individuals who may have an occupationally related illness should be referred to an occupational/environmental physician for evaluation, following any needed initial care. Clinic contact information is available from the New York State Department of Health at www.health.state.ny.us/environmental/workplace/clinic_network.

Environmental Assessment

The presence of mold growth, water damage, or musty odors should be addressed quickly. In all instances, any sources of water must be identified and corrected and the extent of water damage and any mold growth determined. Water-damaged materials should be removed or cleaned and dried. For additional information on cleaning water-damaged materials and personal belongings, refer to the EPA document "Mold Remediation in Schools and Commercial Buildings."[9]

A trained building or environmental health professional may be helpful in assessing the extent of the moisture problem and mold growth and developing a site-specific work plan. The presence of a trained professional to provide oversight during remediation can also be helpful to ensure quality work and compliance with the work plan. According to the American Industrial Hygiene Association a trained professional should have, at a minimum, a relevant science or engineering degree and two years of full-time supervised experience in mold assessment.[10]

Visual Inspection

A visual inspection is the most important initial step in identifying a possible mold problem and in determining remedial strategies. The extent of any water damage and mold growth should be visually assessed and the affected building materials identified. A visual inspection should also include observations of hidden areas where damages may be present, such as crawl spaces, attics, and behind wallboard. Carpet backing and padding, wallpaper, moldings (*e.g.* baseboards), insulation and other materials that are suspected of hiding mold growth should also be assessed.

Ceiling tiles, paper-covered gypsum wallboard (drywall), structural wood, and other cellulose-containing surfaces should be given careful attention during a visual inspection. Ventilation systems should be visually checked for damp conditions and/or mold growth on system components such as filters, insulation, and coils/fins, as well as for overall cleanliness.

Equipment such as a moisture meter or infrared camera (to detect moisture in building materials) or a borescope (to view spaces in ductwork or behind walls) may be helpful in identifying hidden sources of mold growth, the extent of water damage, and in determining if the water source is active.

Using personal protective equipment such as gloves and respiratory protection (*e.g.* N-95 disposable respirator) should be considered if assessment work might disturb mold. Efforts should also be made to minimize the generation and migration of any dust and mold.

Environmental Sampling

Environmental sampling is **not** usually necessary to proceed with remediation of visually identified mold growth or water-damaged materials. Decisions about appropriate remediation strategies can generally be made on the basis of a thorough visual inspection. Environmental sampling may be helpful in some cases, such as, to confirm the presence of visually identified

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mold or if the source of perceived indoor mold growth cannot be visually identified.

If environmental samples will be collected, a sampling plan should be developed that includes a clear purpose, sampling strategy, and addresses the interpretation of results. [11,12] Many types of sampling can be performed (*e.g.* air, surface, dust, and bulk materials) on a variety of fungal components and metabolites, using diverse sampling methodologies. Sampling methods for fungi are not well standardized, however, and may yield highly variable results that can be difficult to interpret.[11-17] Currently, there are no standards, or clear and widely accepted guidelines with which to compare results for health or environmental assessments.

Environmental sampling should be conducted by an individual who is trained in the appropriate sampling methods and is aware of the limitations of the methods used. Using a laboratory that specializes in environmental mycology is also recommended. The laboratory should be accredited in microbiology by an independent and reputable certifying organization.

For additional information on sampling, refer to the American Conference of Governmental Industrial Hygienists' publication, "Bioaerosols: Assessment and Control" and the American Industrial Hygiene Association's " Field Guide for the Determination of Biological Contaminants in Environmental Samples."[11,18]

Remediation

The goal of remediation is to remove or clean mold-damaged materials using work practices that protect occupants by controlling the dispersion of mold from the work area and protect remediation workers from exposures to mold. The listed remediation methods were designed to achieve this goal; however, they are not meant to exclude other similarly effective methods and are not a substitute for a site-specific work plan. Since little scientific information exists that evaluates the effectiveness and best practices for mold remediation, these guidelines are based on principles used to remediate common indoor environmental hazards. These guidelines are not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites.

Prior to any remediation, consideration must be given to the potential presence of other environmental hazards, such as asbestos and lead. These guidelines are based on possible health risks from mold exposure and may be superseded by standard procedures for the remediation of other indoor environmental hazards.

Moisture Control and Building Repair

In all situations, the underlying moisture problem must be corrected to prevent recurring mold growth. Indoor moisture can result from numerous causes, such as: façade and roof leaks; plumbing leaks; floods; condensation; and high relative humidity. An appropriate building expert may be needed to identify and repair building problems. An immediate response

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and thorough cleaning, drying, and/or removal of water-damaged materials will prevent or limit microbial growth.

Relative humidity should generally be maintained at levels below 65% to inhibit mold growth.[19] Short-term periods of higher humidity would not be expected to result in mold growth.[20] However, condensation on cold surfaces could result in water accumulation at much lower relative humidity levels. Relative humidity should be kept low enough to prevent condensation on windows and other surfaces.

Emphasis should be placed on ensuring proper repairs of the building infrastructure so that water intrusion and moisture accumulation is stopped and does not recur.

Worker Training

Proper training of workers is critical in successfully and safely remediating mold growth.[21,22] Training topics that should be addressed include:

- Causes of moisture intrusion and mold growth
- Health concerns related to mold exposure
- The use of appropriate personal protective equipment
- Mold remediation work practices, procedures, and methods

For additional information, the National Institute of Environmental Health Sciences' publication, "Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold" lists minimum training criteria for building maintenance and mold remediation workers that should be completed before addressing indoor mold growth.[23]

Trained building maintenance staff can address limited and occasional mold growth. For larger jobs, more extensively trained mold remediation workers may be needed.

Cleaning Methods

Non-porous materials (*e.g.* metals, glass, and hard plastics) can almost always be cleaned. Semi-porous and porous structural materials, such as wood and concrete can be cleaned if they are structurally sound. Porous materials, such as ceiling tiles and insulation, and wallboards (with more than a small area of mold growth) should be removed and discarded. Wallboard should be cleaned or removed at least six inches beyond visually assessed mold growth (including hidden areas, see ***Visual Inspection***) or wet or water-damaged areas.[24] A professional restoration consultant should be contacted to restore valuable items that have been damaged.

Cleaning should be done using a soap or detergent solution. Use the gentlest cleaning method that effectively removes the mold to limit dust generation. All materials to be reused should be dry and visibly free from mold. Consideration should also be given to cleaning surfaces and materials adjacent to areas of mold growth for settled spores and fungal fragments. A vacuum

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equipped with a High-Efficiency Particulate Air (HEPA) filter could also be used to clean these adjacent areas.

Disinfectants are seldom needed to perform an effective remediation because removal of fungal growth remains the most effective way to prevent exposure. Disinfectant use is recommended when addressing certain specific concerns such as mold growth resulting from sewage waters. If disinfectants are considered necessary, additional measures to protect workers and occupants may also be required. Disinfectants must be registered for use by the United States Environmental Protection Agency (EPA). Any antimicrobial products used in a HVAC system must be EPA-registered specifically for that use.

The use of gaseous, vapor-phase, or aerosolized (*e.g.* fogging) biocides for remedial purposes is **not** recommended. Using biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold.

Quality Assurance Indicators

Measures to ensure the quality and effectiveness of remediation should be undertaken regardless of the project size. Evaluations *during* as well as *after* remediation should be conducted to confirm the effectiveness of remedial work, particularly for large-scale remediation. At minimum, these quality assurance indicators should be followed and documented:

- The underlying moisture problem was identified and eliminated
- Isolation of the work area was appropriate and effective
- Mold removal and worksite cleanup was performed according to the site-specific plan
- Any additional moisture or mold damage discovered during remediation was properly addressed
- Upon completion of remediation, surfaces are free from visible dust and debris.
- If environmental sampling was performed, the results of such sampling were evaluated by a trained building or environmental health professional.[10]

Restoring Treated Spaces

After completing mold remediation and correcting moisture problems, building materials that were removed should be replaced and brought to an intact and finished condition. The use of new building materials that do not promote mold growth should be considered. Anti-microbial paints are usually unnecessary after proper mold remediation. They should not be used in lieu of mold removal and proper moisture control, but may be useful in areas that are reasonably expected to be subject to moisture.

Remediation Procedures

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Three different sizes of remediation and the remediation of heating, ventilation, and air-conditioning (HVAC) systems are described below. Currently, existing research does not relate the amount of mold growth to the frequency or severity of health effects. However, as the presence of moldy materials increases, so does the potential for exposure[8] and the need to limit the spread of mold-containing dusts and worker exposures. As such, the size of the area impacted by mold growth as well as practical considerations were used to help define remedial procedures.

Since the following areas were arbitrarily selected, site-specific conditions must be considered in choosing adequate remediation procedures. For more information on the unique characteristics of building types and occupancies that may influence remediation procedures refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[25]

Small Isolated Areas (less than 10 square feet) – *e.g.* ceiling tiles, small areas on walls

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) If work may impact difficult-to-clean surfaces or items (e.g. carpeting, electronic equipment), the floor of the work area, egress pathways, and other identified materials/belongings should be removed or covered with plastic sheeting and sealed with tape before remediation.

(e) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in a sealed plastic bag(s). Plastic sheeting should be discarded after use. There are no special requirements for the disposal of moldy materials.

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

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Medium-Sized Isolated Areas (10 – 100 square feet)

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) Cover the floor, egress pathways, and items left in the work area with plastic sheeting and seal with tape before remediation.

(e) Seal ventilation ducts/grills and other openings in the work area with plastic sheeting. The HVAC system servicing this area may need to be shut down to properly seal vents.

(f) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(g) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in sealed plastic bags. Plastic sheeting should be discarded after use. There are no special requirements for disposal of moldy materials.

(h) The work area and areas used by workers for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution.

(i) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

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Large Areas (greater than 100 square feet in a contiguous area) – *e.g.* on separate walls in a single room

Properly trained and equipped mold remediation workers should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) to provide oversight during remediation may be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

(b) Containment of the affected area:

i. The HVAC system servicing this area should be shut down during remediation.
ii. Isolation of the work area using plastic sheeting sealed with duct tape. Furnishings should be removed from the area. Ventilation ducts/grills, any other openings, and remaining fixtures/furnishings should be covered with plastic sheeting sealed with duct tape.
iii. Consider using an exhaust fan equipped with a HEPA filter to generate negative pressurization.
iv. Consider using airlocks and a clean changing room.
v. Egress pathways should also be covered if a clean changing room is not used.

(c) The work area should be unoccupied.

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) Moldy materials, that can be cleaned, should be cleaned using a soap or detergent solution. 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 soap or detergent solution or HEPA-vacuumed in the work area (or clean changing room) prior to their transport to unaffected areas of the building. There are no special requirements for the disposal of moldy materials.

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(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dusts outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop with a soap or detergent solution and be visibly clean prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Remediation of HVAC Systems

Mold growth in heating, ventilation, and air-conditioning (HVAC) systems can pose building-wide problems. Obtaining professional help should always be considered in addressing even small amounts of mold growth or moisture problems within an HVAC system. Recurring problems, regardless of size, may indicate a systemic problem and appropriate professional help should be sought.

Small Isolated Area of Mold Growth in the HVAC System (<10 square feet) – *e.g.* box filter, small area on insulation

(a) Remediation can be conducted by trained building maintenance staff that are familiar with the design and function of the impacted HVAC system. Such persons should receive training on proper cleaning 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.* N-95 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) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) The use of plastic sheeting to isolate other sections of the system should be considered.

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(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed and sealed in plastic bags. There are no special requirements for the disposal of moldy materials.

(g) The work area and areas used for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution. Any plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Large Area of Mold Growth in the HVAC System (>10 square feet)

Properly trained and equipped mold remediation workers with specific training and experience in HVAC systems, should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) with experience and specific knowledge of HVAC systems, to provide oversight during remediation can be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

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

(c) Containment of the affected area:

i. 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 equipped with a HEPA filter to generate negative pressurization should be considered
iii. Consider using airlocks and a clean changing room
iv. Egress pathways should also be covered if a clean changing room is not used

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that

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create excessive dust should be avoided.

(e) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a soap or detergent solution or HEPA-vacuumed prior to their removal from the isolated work area. There are no special requirements for the disposal of moldy materials.

(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dust outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Communication with Building Occupants

Communication with occupants of affected spaces is important regardless of the size of the project but is especially important when mold growth requiring large-scale remediation is found. When large-scale remediation is performed, the building owner, management, and/or employer should notify occupants in the building. 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. Building occupants should be provided with a copy of all inspection reports upon request. For more detailed information on risk communication refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[26]

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Appendix A

Health Effects

Several comprehensive reviews of the scientific literature on the health effects of mold in indoor spaces have been published in recent years.[1-3] This appendix reflects these reviews but has also considered more recently published articles.

Potential for Exposure and Health Effects

Fungi are common in both indoor and outdoor environments and play a vital role in the earth's ecology by decomposing organic matter such as dead trees and leaves. As a result, all people have routine exposure to fungi, which may occur through inhalation, ingestion, and touching moldy surfaces. The main route of exposure to mold for people living or working in moldy indoor environments is inhalation of airborne fungal spores, fragments, or metabolites.[2] Ingestion and dermal exposures are less understood in these scenarios and can easily be minimized or prevented by workers through proper hygiene and work practices. Therefore, the remaining discussion will focus on the adverse health effects of mold due to inhalational exposure.

Adverse health effects may include: allergic reactions; toxic effects and irritation; and infections.[1-5] The mere presence of mold growth does not necessarily indicate that people present in the area will exhibit adverse health effects. However, as the amount of mold-impacted materials increases, so do potential exposures. Certain exposures may represent a significant risk such as occupational exposures to high concentrations of fungi and chronic (long-term) exposures, especially of individuals with underlying health conditions such as asthma, compromised immune systems, or allergies.

Evidence linking mold exposures to severe human health effects is documented in reports of occupational disease, particularly in forestry and agricultural settings where inhalation exposures were typically high and/or chronic.[2,6-11] The intensity of mold exposure and associated health effects experienced in undisturbed indoor environments is usually much less severe than that experienced by agricultural or forestry workers.[2,7,12-14] With the possible exception of exposures from mold remediation work, such high-level exposures are not expected indoors.[15-16] Although high-level exposures are unlikely to occur in undisturbed indoor settings, chronic exposures to lower levels may still raise health concerns.

Several factors influence the likelihood that individuals might experience health effects following exposure to mold in indoor environments. These include: the nature of the fungal material (e.g., allergenic, toxic/irritant, or infectious); the degree of exposure (amount and duration); and the susceptibility of exposed people. Susceptibility varies with genetic predisposition, age, state of health, concurrent exposures, and previous sensitization. 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.[17]

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In addition to the adverse health effects associated with exposure to mold, in 2004, the Institute of Medicine (IOM) reported health risks associated with living in damp indoor environments. The IOM reported evidence suggesting an association between damp indoor environments and the development of asthma. Reported respiratory symptoms included, wheezing, coughing, and exacerbation of asthma.[2]

Allergic and Hypersensitivity Effects

It is well established that fungi can cause allergic reactions in humans. The most common symptoms associated with allergic reactions include runny nose, sneezing, post-nasal drip with sore throat, eye irritation, cough, wheeze, and other symptoms associated with the aggravation of asthma.[2,13,18-23] Immunological responses to mold include allergic rhinitis, hypersensitivity pneumonitis, and asthma exacerbations. These conditions require prior exposure for sensitization. These symptoms may persist for some time after removal from the source.

Allergic rhinitis is a group of symptoms that mostly affects the mucous membranes of nasal passages and may result from an allergic reaction to fungi. Symptoms often associated with "hay fever" such as congestion, runny nose, and sneezing may occur.[5,24]

Hypersensitivity pneumonitis (HP) is a rare lung disease with delayed onset (3-8 hours) of fever, shortness of breath, cough, chest tightness, chills, and general malaise. With continued exposure, HP can lead to permanent lung disease. The occurrence of HP, even among those that are highly exposed to fungi, is rare. HP has typically been associated with repeated heavy exposures in forestry and agricultural settings, which raises concerns for workers routinely performing mold remediation, but has also been reported in indoor settings with lower level chronic exposures.[3,11,18,25-27]

Allergic bronchopulmonary aspergillosis (ABPA) and allergic fungal sinusitis (AFS) are examples of rarely occurring allergic reactions to non-invasive fungal growth in the respiratory system. Most symptoms are non-specific resembling asthma or chronic sinusitis. In addition, ABPA and AFS usually occur in those with underlying medical problems. In the case of ABPA, this includes cystic fibrosis, asthma, and other predisposing medical conditions.[28,29]

Recent studies, which have suggested an association between the presence of indoor mold and the development of asthma or allergies, are limited and difficult to interpret. Stark *et al.* found higher concentrations of dust-borne mold in infants' homes were associated with development of allergic rhinitis, which is a known risk factor for childhood asthma.[24] However, other studies have shown higher concentrations of dust-borne fungi and other microorganisms in infants' homes were associated with a *decreased* risk for asthma and wheezing.[30,31] Jaakkola et al. reported an association between a moldy odor in the home and development of asthma, but no association with visible mold or water damage was found. Although the sample size for this subset was small, it suggests that active mold growth might be a stronger risk factor for certain health effects than presence of nonviable or inactive mold alone.[32] This also is supported by recent studies that have shown allergen production is significantly increased during active growth.[33,34]

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Though available, allergy testing for molds is limited, subject to high rates of error, and can be difficult to interpret. Preparations for skin testing or the specific antigen in blood tests may be different from the mold to which an individual is sensitive. A positive test indicates an allergic response but does not definitively link a specific mold exposure to an individual's current health condition.[5]

Irritant and Toxic Effects

Irritant Effects

Indoor growth of mold can lead to the production of volatile organic compounds (VOCs), also referred to as microbial VOCs (MVOCs), and the presence of fungal glucans.[13,35-38] Glucans are components of many fungal cell walls. Some studies have reported an association with the inhalation of glucans and airway irritation and inflammation, but results have been mixed and may not be applicable to expected indoor concentrations. Observed effects may also be the result of exposure to or contact with other fungal components, metabolites, or synergistic effects with other microbial agents.[17,36,39] Resolution of irritant symptoms upon removal from the source can help distinguish irritant effects from allergic symptoms.[5]

MVOCs are responsible for the musty odor often associated with mold growth, which may be noticeable at very low concentrations. Many of the MVOCs are common to other sources in the home.[40] The very low levels usually found indoors have not been shown to cause health effects.[35,37]

Toxic Effects

Some symptoms and maladies have been attributed to the toxic effects of fungi in indoor environments. Certain fungi can produce toxins (mycotoxins) at varying levels that are dependent on many complex environmental and biological factors.[41] The reported symptoms from exposure to mycotoxins indoors include headaches, irritation, and nausea/loss of appetite, but are often non-specific (*e.g.* fatigue, inability to concentrate/remember), and may be caused by other environmental and non-environmental agents.[2,42-46] Although health effects from exposures to mycotoxins have been associated with certain occupational exposures or ingestion of mold-contaminated food, scientific support for the reported effects in indoor environments has not been established. This may be due to the lower levels of exposure and different routes of exposure.[2,5,13,21,27,46-49]

Stachybotrys is colloquially referred to as "black mold" or "toxic mold." It has been suggested that toxins produced by this mold are associated with specific health effects. Acute Idiopathic Pulmonary Hemorrhage (AIPH) in infants has been described in several reports suggesting a relationship with *Stachybotrys*. AIPH is an uncommon condition that results in bleeding in the lungs. The IOM reviewed the existing studies and concluded that there was insufficient evidence to determine if mold exposure was associated with AIPH.[2,3] The evidence is also insufficient for an association between inhalation of *Stachybotrys* toxins indoors and neurological damage.[2,26,49] Although severe health effects from the inhalation exposures to

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Stachybotrys toxins indoors is plausible, it is not well-supported, and the issue remains controversial.[2,3,5,27,49,50]

Organic dust toxic syndrome (ODTS) describes the abrupt onset of fever, flu-like symptoms, and respiratory symptoms in the hours following a single, heavy exposure to dust-containing fungi and other microorganisms. Unlike HP, ODTS does not require repeated exposures to bioaerosols and can occur after the first exposure. ODTS has been documented in farm workers handling contaminated material, but may also affect workers performing remediation of building materials with widespread mold growth.[2,11,27] ODTS is a self-limited illness, which usually improves within 24 hours after the discontinuation of exposure. It may be underreported among workers exposed to fungi, but would not be expected in occupants of buildings with mold growth.[11,27]

Infectious Disease

Only a small number of fungi have been associated with infectious disease. Few of these fungi are typically found in the indoor environment.[51,52] Several species of *Aspergillus* are known to cause aspergillosis, most commonly *A. fumigatus*, *A. flavus,* and rarely, other species. Aspergillosis is a disease that generally affects severely immunosuppressed persons. Exposure to these molds, even in high concentrations, is unlikely to cause infection in healthy individuals.[21,53] Heavy 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. More severe health effects are primarily encountered in immunocompromised persons.[18,54]

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Model Mold Remediation Work Plan

Contractor Name: ______________________________
Address: ______________________________

Location: ______________________________
____
____
____

This plan has been prepared by the Remediation Contractor to comply with New York State Labor Law Article 32 and shall be provided to client before site preparation work begins.

Prepared By: ______________________________
Date Prepared: ______________________________
NYSDOL License #: ______________________________

Signature: ______________________________

Date provided to Client: ________________________
Form of Transmittal: ________________________
e.g. certified mail, hand delivered:

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1. Description of Work:

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2. Personal Protective Equipment

3. Standard Operating Procedures:

a. Occupant notification will be conducted per the remediation plan. Work area and areas directly adjacent will be unoccupied and posted with appropriate signage and barrier tape and will remain this way until a satisfactory post-remediation clearance assessment is achieved. Signs advising that a mold remediation project is in progress and only authorized personnel shall enter will be displayed at all accessible entrances to remediation areas.

b. Remediation will be conducted consistent with the New York City Department of Health & Mental Hygiene “Guidelines on Assessment and Remediation of Fungi in Indoor Environments”, 2008 edition and USEPA “Mold Remediation in Schools and Commercial Buildings”.

c. Containment of the affected area will be prepared per NYC Guidelines:

1) The HVAC system servicing this area will be shut down during remediation.
2) A personal decontamination facility, comprised of an airlock and changing room will be attached to the work area and serve as the primary egress to the work area.
3) Isolation of the work area shall be accomplished using plastic sheeting sealed with duct tape.
4) Ventilation ducts/grills, any other openings, and remaining fixtures/furnishings will be covered with plastic sheeting sealed with duct tape.
5) Install an exhaust fan equipped with a HEPA filter to generate negative pressurization.

d. Efforts will be made to reduce dust generation, including:
1) cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal;
2) Use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; using a vacuum equipped with a HEPA filter at the point of dust generation.
3) Work practices that create excessive dust will be avoided.

e. Cleaning

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1) Before leaving isolated areas, workers will remove disposable clothing to prevent the tracking of mold-containing dusts outside of the work area.
2) The work area and egress pathways (and clean changing room if present) will be HEPA-vacuumed and cleaned with a damp cloth and/or mop with a soap or detergent solution and be visibly clean prior to the removal of isolation barriers. Plastic sheeting will be discarded after use.
3) All areas will be left dry and visibly free from mold, dust, and debris.

f. Disinfectants, Antimicrobials & Coatings - The intended disinfectant is _________ The intended antimicrobial coating is ___________. This product is registered with the USEPA for its intended use and will be used following the manufacturer's specifications.

g. All hard surfaces will be scrubbed with non-metallic scrub brushes and sealed properly with a fungicidal coating after cleaning is complete and post remedial clearance is achieved.

1) Porous materials:
   i. Remove all visual (active) fungal contamination
   ii. HEPA vacuum transitory fungal accumulation.
2) Non-porous materials:
   i. Surface Fungal Contamination -treat in place-wipe down/abrasive treatment, HEPA vacuum, biocide treatment.
   ii. Sub-surface Fungal Contamination (rots)-remove with care relative to structural integrity. Engineering oversight may be required.
   iii. Transitory Fungal Accumulation-HEPA Vacuum, wipe down, biocide treatment.
3) Salvageable Contents Cleaning will be performed per the following table:

Affected Material or Furnishing	Clean-up Methods*
Books & Papers	3
Carpet & Backing	4
Concrete or Cinder block	2,3
Hard surface, tile, vinyl, linoleum	1,2,3
Plastics & Metals	1,2,3
Toys, Upholstered furniture & drapes	1,2,3,4
Gypsum	2,3,4
Wood	2,3,4

1. *Method 1: Wet HEPA vacuum, steam cleaning or dry cleaning.
2. Method 2: Biocide
3. Method 3: HEPA vacuum.
4. Method 4: Discard; apply biocide and HEPA vacuum area after biocide is dried

h. Non- Salvageable & adjacent spaces

i. All non-salvageable materials with a mold growth will be disposed
ii. All floors in adjacent non-remediation areas will be treated as Transitory Fungal Accumulation impacted. HEPA Vacuum and air scrubbing techniques will be used during the remediation.

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4. **Disposal**

All mold contaminated waste, including plastic sheeting and disposable clothing, shall be containerized in 6 mil contractor bags, removed from the premises daily and disposed per applicable regulations to an unclean place outside of town.

5. **Firm & Staff Credentials**

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AttendeeFirstName AttendeeLastName

Street Address
City, State Zip Code

Successfully completed the 16 hour NYSDOL accredited:

Mold Remediation Worker
Initial Certification Training

Pursuant to Article 32, Section 932 of the New York State Labor Law

Certificate Number: MRW-15-1231-01

Course Examination Date:	December 31, 2015
Course Completion Date:	December 31, 2015
Course Expiration Date:	December 31, 2017

Andrew J. McLellan
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AttendeeFirstName AttendeeLastName

Street Address

City, State Zip Code

Successfully completed the 24 hour NYSDOL accredited:

Mold Remediation Contractor
Initial Certification Training

Pursuant to Article 32, Section 932 of the New York State Labor Law

Certificate Number: MRC-15-1231-01

Course Examination Date:	December 31, 2015
Course Completion Date:	December 31, 2015
Course Expiration Date:	December 31, 2017

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6. Appendix – NYC Guidelines

Guidelines

on

Assessment and Remediation of Fungi in Indoor Environments

New York City Department of Health and Mental Hygiene

November 2008

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Preface

This 2008 document revises existing guidelines and supersedes all prior editions. It is based both on a review of the current literature regarding fungi (mold) and on comments from a review panel consisting of experts in the fields of mycology/microbiology, environmental health sciences, environmental/occupational medicine, industrial hygiene, and environmental remediation.

These guidelines are intended for use by building owners and managers, environmental contractors and environmental consultants. It is also available for general distribution to anyone concerned about indoor mold growth. The attached fact sheet, "*Mold Growth: Prevention and Cleanup for Building Owners and Managers*," is a simplified summary of these guidelines, which may be useful for building owners, managers and workers. It is strongly recommended that the complete guidelines be referred to before addressing the assessment or remediation of indoor mold growth.

In 1993, the New York City Department of Health and Mental Hygiene (DOHMH) first issued recommendations on addressing mold growth indoors. In 2000, DOHMH made major revisions to the initial guidance and made minor edits in 2002.

The terms *fungi* and *mold* are used interchangeably throughout this document.

This document should be used only as guidance. It is not a substitute for a site-specific assessment and remediation plan and is not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites. Currently there are no United States Federal, New York State, or New York City regulations for the assessment or remediation of mold growth.

These guidelines are available to the public, but may not be reprinted or used for any commercial purpose except with the express written permission of the DOHMH. These guidelines are subject to change as more information regarding this topic becomes available.

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These guidelines were prepared by the Environmental and Occupational Disease Epidemiology Unit of the New York City Department of Health and Mental Hygiene. This document, and any future revisions, is available online at nyc.gov/health. For further information please call 311 or (212) NEW-YORK (from outside the City). **November 2009**

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Introduction

Fungi (mold) are present almost everywhere. In an indoor environment hundreds of different kinds of mold are able to grow wherever there is moisture and an organic substrate (food source). They can grow on building and other materials, including: the paper on gypsum wallboard (drywall); ceiling tiles; wood products; paint; wallpaper; carpeting; some furnishings; books/papers; clothes; and other fabrics. Mold can also grow on moist, dirty surfaces such as concrete, fiberglass insulation, and ceramic tiles. It is neither possible nor warranted to eliminate the presence of all indoor fungal spores and fragments; however, mold growth indoors can and should be prevented and removed if present.

The purpose of these guidelines is to provide an approach to address potential and observed mold growth on structural materials in commercial, school, and residential buildings. Mold growth in critical care areas of health-care facilities such as intensive care units or surgery suites may pose significant health concerns to patients. This document is not intended for such situations. Please visit the US Centers for Disease Control and Prevention (CDC) at www.cdc.gov for more information on dealing with mold growth and its cleanup in health-care facilities.[1] Mold on bathroom tile grout, in shower stalls, and on bathtubs is a common occurrence. Occupants can control this growth through frequent use of household cleaners.

Water accumulation in indoor environments can lead to mold growth (and other environmental problems), which has been associated with human health effects (see ***Appendix A***).[2-6] Indoor mold growth can be prevented or minimized, however, by actively maintaining, inspecting, and correcting buildings for moisture problems and immediately drying and managing water-damaged materials. In the event that mold growth does occur, this guide is intended to assist those responsible for maintaining facilities in evaluating and correcting this problem.

Removing mold growth and correcting the underlying cause of water accumulation can help to reduce mold exposures and related health symptoms.[7,8] Prompt remediation of mold-damaged materials and infrastructure repair should be the primary response to mold growth in buildings. The simplest, most expedient remediation that properly and safely removes mold growth from buildings should be used. Extensive mold growth poses more difficult problems that should be addressed on a case-by-case basis in consultation with an appropriate building or environmental health professional. In all situations, the source of water must be identified and corrected or the mold growth will recur.

Effective communication with building occupants is an important component of all remedial efforts. Individuals who believe they have mold-related health problems should see their physicians. Individuals who may have an occupationally related illness should be referred to an occupational/environmental physician for evaluation, following any needed initial care. Clinic contact information is available from the New York State Department of Health at www.health.state.ny.us/environmental/workplace/clinic_network.

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Environmental Assessment

The presence of mold growth, water damage, or musty odors should be addressed quickly. In all instances, any sources of water must be identified and corrected and the extent of water damage and any mold growth determined. Water-damaged materials should be removed or cleaned and dried. For additional information on cleaning water-damaged materials and personal belongings, refer to the EPA document "Mold Remediation in Schools and Commercial Buildings."[9]

A trained building or environmental health professional may be helpful in assessing the extent of the moisture problem and mold growth and developing a site-specific work plan. The presence of a trained professional to provide oversight during remediation can also be helpful to ensure quality work and compliance with the work plan. According to the American Industrial Hygiene Association a trained professional should have, at a minimum, a relevant science or engineering degree and two years of full-time supervised experience in mold assessment.[10]

Visual Inspection

A visual inspection is the most important initial step in identifying a possible mold problem and in determining remedial strategies. The extent of any water damage and mold growth should be visually assessed and the affected building materials identified. A visual inspection should also include observations of hidden areas where damages may be present, such as crawl spaces, attics, and behind wallboard. Carpet backing and padding, wallpaper, moldings (*e.g.* baseboards), insulation and other materials that are suspected of hiding mold growth should also be assessed.

Ceiling tiles, paper-covered gypsum wallboard (drywall), structural wood, and other cellulose-containing surfaces should be given careful attention during a visual inspection. Ventilation systems should be visually checked for damp conditions and/or mold growth on system components such as filters, insulation, and coils/fins, as well as for overall cleanliness.

Equipment such as a moisture meter or infrared camera (to detect moisture in building materials) or a borescope (to view spaces in ductwork or behind walls) may be helpful in identifying hidden sources of mold growth, the extent of water damage, and in determining if the water source is active.

Using personal protective equipment such as gloves and respiratory protection (*e.g.* N-95 disposable respirator) should be considered if assessment work might disturb mold. Efforts should also be made to minimize the generation and migration of any dust and mold.

Environmental Sampling

Environmental sampling is **not** usually necessary to proceed with remediation of visually identified mold growth or water-damaged materials. Decisions about appropriate remediation strategies can generally be made on the basis of a thorough visual inspection. Environmental sampling may be helpful in some cases, such as, to confirm the presence of visually identified

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mold or if the source of perceived indoor mold growth cannot be visually identified.

If environmental samples will be collected, a sampling plan should be developed that includes a clear purpose, sampling strategy, and addresses the interpretation of results. [11,12] Many types of sampling can be performed (*e.g.* air, surface, dust, and bulk materials) on a variety of fungal components and metabolites, using diverse sampling methodologies. Sampling methods for fungi are not well standardized, however, and may yield highly variable results that can be difficult to interpret.[11-17] Currently, there are no standards, or clear and widely accepted guidelines with which to compare results for health or environmental assessments.

Environmental sampling should be conducted by an individual who is trained in the appropriate sampling methods and is aware of the limitations of the methods used. Using a laboratory that specializes in environmental mycology is also recommended. The laboratory should be accredited in microbiology by an independent and reputable certifying organization.

For additional information on sampling, refer to the American Conference of Governmental Industrial Hygienists' publication, "Bioaerosols: Assessment and Control" and the American Industrial Hygiene Association's " Field Guide for the Determination of Biological Contaminants in Environmental Samples."[11,18]

Remediation

The goal of remediation is to remove or clean mold-damaged materials using work practices that protect occupants by controlling the dispersion of mold from the work area and protect remediation workers from exposures to mold. The listed remediation methods were designed to achieve this goal; however, they are not meant to exclude other similarly effective methods and are not a substitute for a site-specific work plan. Since little scientific information exists that evaluates the effectiveness and best practices for mold remediation, these guidelines are based on principles used to remediate common indoor environmental hazards. These guidelines are not intended for use in critical care facilities such as intensive care units, transplant units, or surgical suites.

Prior to any remediation, consideration must be given to the potential presence of other environmental hazards, such as asbestos and lead. These guidelines are based on possible health risks from mold exposure and may be superseded by standard procedures for the remediation of other indoor environmental hazards.

Moisture Control and Building Repair

In all situations, the underlying moisture problem must be corrected to prevent recurring mold growth. Indoor moisture can result from numerous causes, such as: façade and roof leaks; plumbing leaks; floods; condensation; and high relative humidity. An appropriate building expert may be needed to identify and repair building problems. An immediate response

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and thorough cleaning, drying, and/or removal of water-damaged materials will prevent or limit microbial growth.

Relative humidity should generally be maintained at levels below 65% to inhibit mold growth.[19] Short-term periods of higher humidity would not be expected to result in mold growth.[20] However, condensation on cold surfaces could result in water accumulation at much lower relative humidity levels. Relative humidity should be kept low enough to prevent condensation on windows and other surfaces.

Emphasis should be placed on ensuring proper repairs of the building infrastructure so that water intrusion and moisture accumulation is stopped and does not recur.

Worker Training

Proper training of workers is critical in successfully and safely remediating mold growth.[21,22] Training topics that should be addressed include:

- Causes of moisture intrusion and mold growth
- Health concerns related to mold exposure
- The use of appropriate personal protective equipment
- Mold remediation work practices, procedures, and methods

For additional information, the National Institute of Environmental Health Sciences' publication, "Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold" lists minimum training criteria for building maintenance and mold remediation workers that should be completed before addressing indoor mold growth.[23]

Trained building maintenance staff can address limited and occasional mold growth. For larger jobs, more extensively trained mold remediation workers may be needed.

Cleaning Methods

Non-porous materials (*e.g.* metals, glass, and hard plastics) can almost always be cleaned. Semi-porous and porous structural materials, such as wood and concrete can be cleaned if they are structurally sound. Porous materials, such as ceiling tiles and insulation, and wallboards (with more than a small area of mold growth) should be removed and discarded. Wallboard should be cleaned or removed at least six inches beyond visually assessed mold growth (including hidden areas, see ***Visual Inspection***) or wet or water-damaged areas.[24] A professional restoration consultant should be contacted to restore valuable items that have been damaged.

Cleaning should be done using a soap or detergent solution. Use the gentlest cleaning method that effectively removes the mold to limit dust generation. All materials to be reused should be dry and visibly free from mold. Consideration should also be given to cleaning surfaces and materials adjacent to areas of mold growth for settled spores and fungal fragments. A vacuum

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equipped with a High-Efficiency Particulate Air (HEPA) filter could also be used to clean these adjacent areas.

Disinfectants are seldom needed to perform an effective remediation because removal of fungal growth remains the most effective way to prevent exposure. Disinfectant use is recommended when addressing certain specific concerns such as mold growth resulting from sewage waters. If disinfectants are considered necessary, additional measures to protect workers and occupants may also be required. Disinfectants must be registered for use by the United States Environmental Protection Agency (EPA). Any antimicrobial products used in a HVAC system must be EPA-registered specifically for that use.

The use of gaseous, vapor-phase, or aerosolized (*e.g.* fogging) biocides for remedial purposes is **not** recommended. Using biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold.

Quality Assurance Indicators

Measures to ensure the quality and effectiveness of remediation should be undertaken regardless of the project size. Evaluations *during* as well as *after* remediation should be conducted to confirm the effectiveness of remedial work, particularly for large-scale remediation. At minimum, these quality assurance indicators should be followed and documented:

- The underlying moisture problem was identified and eliminated
- Isolation of the work area was appropriate and effective
- Mold removal and worksite cleanup was performed according to the site-specific plan
- Any additional moisture or mold damage discovered during remediation was properly addressed
- Upon completion of remediation, surfaces are free from visible dust and debris.
- If environmental sampling was performed, the results of such sampling were evaluated by a trained building or environmental health professional.[10]

Restoring Treated Spaces

After completing mold remediation and correcting moisture problems, building materials that were removed should be replaced and brought to an intact and finished condition. The use of new building materials that do not promote mold growth should be considered. Anti-microbial paints are usually unnecessary after proper mold remediation. They should not be used in lieu of mold removal and proper moisture control, but may be useful in areas that are reasonably expected to be subject to moisture.

Remediation Procedures

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Three different sizes of remediation and the remediation of heating, ventilation, and air-conditioning (HVAC) systems are described below. Currently, existing research does not relate the amount of mold growth to the frequency or severity of health effects. However, as the presence of moldy materials increases, so does the potential for exposure[8] and the need to limit the spread of mold-containing dusts and worker exposures. As such, the size of the area impacted by mold growth as well as practical considerations were used to help define remedial procedures.

Since the following areas were arbitrarily selected, site-specific conditions must be considered in choosing adequate remediation procedures. For more information on the unique characteristics of building types and occupancies that may influence remediation procedures refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[25]

Small Isolated Areas (less than 10 square feet) – *e.g.* ceiling tiles, small areas on walls

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) If work may impact difficult-to-clean surfaces or items (e.g. carpeting, electronic equipment), the floor of the work area, egress pathways, and other identified materials/belongings should be removed or covered with plastic sheeting and sealed with tape before remediation.

(e) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in a sealed plastic bag(s). Plastic sheeting should be discarded after use. There are no special requirements for the disposal of moldy materials.

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

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Medium-Sized Isolated Areas (10 – 100 square feet)

(a) Remediation can be conducted by trained building maintenance staff. Such persons should receive training on proper cleaning methods, personal protection, and potential health hazards associated with mold exposure. 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., N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should also be worn.

(c) The work area should be unoccupied.

(d) Cover the floor, egress pathways, and items left in the work area with plastic sheeting and seal with tape before remediation.

(e) Seal ventilation ducts/grills and other openings in the work area with plastic sheeting. The HVAC system servicing this area may need to be shut down to properly seal vents.

(f) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(g) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Materials that cannot be cleaned should be removed from the building in sealed plastic bags. Plastic sheeting should be discarded after use. There are no special requirements for disposal of moldy materials.

(h) The work area and areas used by workers for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution.

(i) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

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Large Areas (greater than 100 square feet in a contiguous area) – *e.g.* on separate walls in a single room

Properly trained and equipped mold remediation workers should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) to provide oversight during remediation may be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

(b) Containment of the affected area:

i. The HVAC system servicing this area should be shut down during remediation.
ii. Isolation of the work area using plastic sheeting sealed with duct tape. Furnishings should be removed from the area. Ventilation ducts/grills, any other openings, and remaining fixtures/furnishings should be covered with plastic sheeting sealed with duct tape.
iii. Consider using an exhaust fan equipped with a HEPA filter to generate negative pressurization.
iv. Consider using airlocks and a clean changing room.
v. Egress pathways should also be covered if a clean changing room is not used.

(c) The work area should be unoccupied.

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) Moldy materials, that can be cleaned, should be cleaned using a soap or detergent solution. 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 soap or detergent solution or HEPA-vacuumed in the work area (or clean changing room) prior to their transport to unaffected areas of the building. There are no special requirements for the disposal of moldy materials.

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(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dusts outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop with a soap or detergent solution and be visibly clean prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Remediation of HVAC Systems

Mold growth in heating, ventilation, and air-conditioning (HVAC) systems can pose building-wide problems. Obtaining professional help should always be considered in addressing even small amounts of mold growth or moisture problems within an HVAC system. Recurring problems, regardless of size, may indicate a systemic problem and appropriate professional help should be sought.

Small Isolated Area of Mold Growth in the HVAC System (<10 square feet) – *e.g.* box filter, small area on insulation

(a) Remediation can be conducted by trained building maintenance staff that are familiar with the design and function of the impacted HVAC system. Such persons should receive training on proper cleaning 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.* N-95 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) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that create excessive dust should be avoided.

(e) The use of plastic sheeting to isolate other sections of the system should be considered.

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(f) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed and sealed in plastic bags. There are no special requirements for the disposal of moldy materials.

(g) The work area and areas used for egress should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution. Any plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Large Area of Mold Growth in the HVAC System (>10 square feet)

Properly trained and equipped mold remediation workers with specific training and experience in HVAC systems, should conduct the remediation. The presence of a trained building or environmental health professional (see ***Environmental Assessment***) with experience and specific knowledge of HVAC systems, to provide oversight during remediation can be helpful to ensure quality work and compliance with the work plan. The following procedures are recommended:

(a) Personnel trained in the handling of mold-damaged materials equipped with:

i. A minimum of half-face elastomeric respirators with P-100 filters used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134)
ii. Full body coveralls with head and foot coverings
iii. Gloves and eye protection

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

(c) Containment of the affected area:

i. 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 equipped with a HEPA filter to generate negative pressurization should be considered
iii. Consider using airlocks and a clean changing room
iv. Egress pathways should also be covered if a clean changing room is not used

(d) Efforts should be made to reduce dust generation. Dust suppression methods particularly during any cutting or resurfacing of materials are highly recommended. Methods to consider include: cleaning or gently misting surfaces with a dilute soap or detergent solution prior to removal; the use of High-Efficiency Particulate Air (HEPA) vacuum-shrouded tools; or using a vacuum equipped with a HEPA filter at the point of dust generation. Work practices that

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create excessive dust should be avoided.

(e) Moldy materials that can be cleaned should be cleaned using a soap or detergent solution. Growth-supporting materials that are moldy, such as the insulation of interior-lined ducts, flexible ducts, and filters, should be removed in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a soap or detergent solution or HEPA-vacuumed prior to their removal from the isolated work area. There are no special requirements for the disposal of moldy materials.

(f) Before leaving isolated areas, workers should remove disposable clothing to prevent the tracking of mold-containing dust outside of the work area.

(g) The work area and egress pathways (and clean changing room if present) should be HEPA-vacuumed and cleaned with a damp cloth and/or mop and a soap or detergent solution prior to the removal of isolation barriers. Plastic sheeting should be discarded after use.

(h) All areas should be left dry and visibly free from mold, dust, and debris. Check that other quality assurance indicators (see ***Quality Insurance Indicators***) have also been met.

Communication with Building Occupants

Communication with occupants of affected spaces is important regardless of the size of the project but is especially important when mold growth requiring large-scale remediation is found. When large-scale remediation is performed, the building owner, management, and/or employer should notify occupants in the building. 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. Building occupants should be provided with a copy of all inspection reports upon request. For more detailed information on risk communication refer to the American Industrial Hygiene Association's publication, "Recognition, Evaluation, and Control of Indoor Mold."[26]

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Appendix A

Health Effects

Several comprehensive reviews of the scientific literature on the health effects of mold in indoor spaces have been published in recent years.[1-3] This appendix reflects these reviews but has also considered more recently published articles.

Potential for Exposure and Health Effects

Fungi are common in both indoor and outdoor environments and play a vital role in the earth's ecology by decomposing organic matter such as dead trees and leaves. As a result, all people have routine exposure to fungi, which may occur through inhalation, ingestion, and touching moldy surfaces. The main route of exposure to mold for people living or working in moldy indoor environments is inhalation of airborne fungal spores, fragments, or metabolites.[2] Ingestion and dermal exposures are less understood in these scenarios and can easily be minimized or prevented by workers through proper hygiene and work practices. Therefore, the remaining discussion will focus on the adverse health effects of mold due to inhalational exposure.

Adverse health effects may include: allergic reactions; toxic effects and irritation; and infections.[1-5] The mere presence of mold growth does not necessarily indicate that people present in the area will exhibit adverse health effects. However, as the amount of mold-impacted materials increases, so do potential exposures. Certain exposures may represent a significant risk such as occupational exposures to high concentrations of fungi and chronic (long-term) exposures, especially of individuals with underlying health conditions such as asthma, compromised immune systems, or allergies.

Evidence linking mold exposures to severe human health effects is documented in reports of occupational disease, particularly in forestry and agricultural settings where inhalation exposures were typically high and/or chronic.[2,6-11] The intensity of mold exposure and associated health effects experienced in undisturbed indoor environments is usually much less severe than that experienced by agricultural or forestry workers.[2,7,12-14] With the possible exception of exposures from mold remediation work, such high-level exposures are not expected indoors.[15-16] Although high-level exposures are unlikely to occur in undisturbed indoor settings, chronic exposures to lower levels may still raise health concerns.

Several factors influence the likelihood that individuals might experience health effects following exposure to mold in indoor environments. These include: the nature of the fungal material (e.g., allergenic, toxic/irritant, or infectious); the degree of exposure (amount and duration); and the susceptibility of exposed people. Susceptibility varies with genetic predisposition, age, state of health, concurrent exposures, and previous sensitization. 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. [17]

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In addition to the adverse health effects associated with exposure to mold, in 2004, the Institute of Medicine (IOM) reported health risks associated with living in damp indoor environments. The IOM reported evidence suggesting an association between damp indoor environments and the development of asthma. Reported respiratory symptoms included, wheezing, coughing, and exacerbation of asthma.[2]

Allergic and Hypersensitivity Effects

It is well established that fungi can cause allergic reactions in humans. The most common symptoms associated with allergic reactions include runny nose, sneezing, post-nasal drip with sore throat, eye irritation, cough, wheeze, and other symptoms associated with the aggravation of asthma.[2,13,18-23] Immunological responses to mold include allergic rhinitis, hypersensitivity pneumonitis, and asthma exacerbations. These conditions require prior exposure for sensitization. These symptoms may persist for some time after removal from the source.

Allergic rhinitis is a group of symptoms that mostly affects the mucous membranes of nasal passages and may result from an allergic reaction to fungi. Symptoms often associated with "hay fever" such as congestion, runny nose, and sneezing may occur.[5,24]

Hypersensitivity pneumonitis (HP) is a rare lung disease with delayed onset (3-8 hours) of fever, shortness of breath, cough, chest tightness, chills, and general malaise. With continued exposure, HP can lead to permanent lung disease. The occurrence of HP, even among those that are highly exposed to fungi, is rare. HP has typically been associated with repeated heavy exposures in forestry and agricultural settings, which raises concerns for workers routinely performing mold remediation, but has also been reported in indoor settings with lower level chronic exposures.[3,11,18,25-27]

Allergic bronchopulmonary aspergillosis (ABPA) and allergic fungal sinusitis (AFS) are examples of rarely occurring allergic reactions to non-invasive fungal growth in the respiratory system. Most symptoms are non-specific resembling asthma or chronic sinusitis. In addition, ABPA and AFS usually occur in those with underlying medical problems. In the case of ABPA, this includes cystic fibrosis, asthma, and other predisposing medical conditions.[28,29]

Recent studies, which have suggested an association between the presence of indoor mold and the development of asthma or allergies, are limited and difficult to interpret. Stark *et al.* found higher concentrations of dust-borne mold in infants' homes were associated with development of allergic rhinitis, which is a known risk factor for childhood asthma.[24] However, other studies have shown higher concentrations of dust-borne fungi and other microorganisms in infants' homes were associated with a *decreased* risk for asthma and wheezing.[30,31] Jaakkola et al. reported an association between a moldy odor in the home and development of asthma, but no association with visible mold or water damage was found. Although the sample size for this subset was small, it suggests that active mold growth might be a stronger risk factor for certain health effects than presence of nonviable or inactive mold alone.[32] This also is supported by recent studies that have shown allergen production is significantly increased during active growth.[33,34]

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Though available, allergy testing for molds is limited, subject to high rates of error, and can be difficult to interpret. Preparations for skin testing or the specific antigen in blood tests may be different from the mold to which an individual is sensitive. A positive test indicates an allergic response but does not definitively link a specific mold exposure to an individual's current health condition.[5]

Irritant and Toxic Effects

Irritant Effects

Indoor growth of mold can lead to the production of volatile organic compounds (VOCs), also referred to as microbial VOCs (MVOCs), and the presence of fungal glucans.[13,35-38] Glucans are components of many fungal cell walls. Some studies have reported an association with the inhalation of glucans and airway irritation and inflammation, but results have been mixed and may not be applicable to expected indoor concentrations. Observed effects may also be the result of exposure to or contact with other fungal components, metabolites, or synergistic effects with other microbial agents.[17,36,39] Resolution of irritant symptoms upon removal from the source can help distinguish irritant effects from allergic symptoms.[5]

MVOCs are responsible for the musty odor often associated with mold growth, which may be noticeable at very low concentrations. Many of the MVOCs are common to other sources in the home.[40] The very low levels usually found indoors have not been shown to cause health effects.[35,37]

Toxic Effects

Some symptoms and maladies have been attributed to the toxic effects of fungi in indoor environments. Certain fungi can produce toxins (mycotoxins) at varying levels that are dependent on many complex environmental and biological factors.[41] The reported symptoms from exposure to mycotoxins indoors include headaches, irritation, and nausea/loss of appetite, but are often non-specific (*e.g.* fatigue, inability to concentrate/remember), and may be caused by other environmental and non-environmental agents.[2,42-46] Although health effects from exposures to mycotoxins have been associated with certain occupational exposures or ingestion of mold-contaminated food, scientific support for the reported effects in indoor environments has not been established. This may be due to the lower levels of exposure and different routes of exposure.[2,5,13,21,27,46-49]

Stachybotrys is colloquially referred to as "black mold" or "toxic mold." It has been suggested that toxins produced by this mold are associated with specific health effects. Acute Idiopathic Pulmonary Hemorrhage (AIPH) in infants has been described in several reports suggesting a relationship with *Stachybotrys*. AIPH is an uncommon condition that results in bleeding in the lungs. The IOM reviewed the existing studies and concluded that there was insufficient evidence to determine if mold exposure was associated with AIPH.[2,3] The evidence is also insufficient for an association between inhalation of *Stachybotrys* toxins indoors and neurological damage.[2,26,49] Although severe health effects from the inhalation exposures to

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Stachybotrys toxins indoors is plausible, it is not well-supported, and the issue remains controversial.[2,3,5,27,49,50]

Organic dust toxic syndrome (ODTS) describes the abrupt onset of fever, flu-like symptoms, and respiratory symptoms in the hours following a single, heavy exposure to dust-containing fungi and other microorganisms. Unlike HP, ODTS does not require repeated exposures to bioaerosols and can occur after the first exposure. ODTS has been documented in farm workers handling contaminated material, but may also affect workers performing remediation of building materials with widespread mold growth.[2,11,27] ODTS is a self-limited illness, which usually improves within 24 hours after the discontinuation of exposure. It may be underreported among workers exposed to fungi, but would not be expected in occupants of buildings with mold growth.[11,27]

Infectious Disease

Only a small number of fungi have been associated with infectious disease. Few of these fungi are typically found in the indoor environment.[51,52] Several species of *Aspergillus* are known to cause aspergillosis, most commonly *A. fumigatus*, *A. flavus,* and rarely, other species. Aspergillosis is a disease that generally affects severely immunosuppressed persons. Exposure to these molds, even in high concentrations, is unlikely to cause infection in healthy individuals.[21,53] Heavy 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. More severe health effects are primarily encountered in immunocompromised persons.[18,54]

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