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**NEW YORK STATE DEPARTMENT OF LABOR
MOLD TRAINING PROGRAM**

MOLD ABATEMENT WORKER INITIAL

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NYS DOL MOLD TRAINING

Mold Assessor Training Presentation



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Welcome

- Registration & sign-in/out
- Training materials
- Training Agenda
- Training Goals
 - Understand importance of controlling mold & moisture
 - Be able to use the tools, practices & procedures
 - Be ready to get this done!



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Why Are We Here Today?

- Because exposure to excessive moisture and mold is considered a major asthma trigger - IDOM 2004, WHO 2009, and NYC DOHMH 2008



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How Long Has Mold Been A Problem?

From Leviticus Chapter 14, verses 33-37

On the seventh day the priest shall return to inspect the house. If the mold has spread on the walls. He is to order that the contaminated stones be torn out and thrown into an unclean place outside the town. He must have all the inside walls of the house scraped and the material that is scrapped of dumped into an unclean place outside the town. Then they are to take other stones to replace these and take new clay and plaster the house.

If the mold reappears in the house after the stones have been torn out and the house scrapped and plastered the priest is to go and examine it and if the mold has spread in the house, it is a destructive mold, the house is unclean. It must be torn down - its stones, timbers and all the plaster - and taken out of the town to an unclean place.

Anyone who goes into the house while it is closed up will be unclean till evening.

Anyone who sleeps or eats in the house must wash his clothes...

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How Mold Grows

- Finds suitable conditions
 - Water
 - Food
 - Temp (hot or cold)
- Grows
- Spreads

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Where Does Mold Grow?

- The paint on plaster, concrete, and sheetrock walls/ceilings
- The paper covering of sheetrock walls/ceilings (front/back and top/bottom sides)
- The covering of pipe-wrap and insulation in wall cavities
- Woodwork and trim
- Bathroom tile grout and caulking
- Kitchen and bathroom cabinetry
- Wood framing materials in wall cavities

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Preventing Mold In Housing



- Mold growth is always associated with excessive moisture problems.
- How do we **prevent** or **control** excessive moisture and what are the root causes of excessive moisture?

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Water Infiltration

- Major cause of mold growth
- Present in app. 75% of all properties
- Moisture is the leading cause of building problems costing more than \$9 billion dollars annually in the US.

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Root-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



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Shower Vapor Condensation



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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

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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 ↑

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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

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Toilet Condensation - In Apartment



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Toilet Condensation - From Above



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Perimeter Wall Condensation



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Plumbing Leaks/Flooding



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Roof Leaks



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Façade Leaks



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Localized Mold Contamination



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Major Mold Infestation



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Exposures To Residential Dampness And Mold

Associated with increased risks of;

- Respiratory symptoms
- Asthma
- Hypersensitivity pneumonitis
- Rhinosinusitis
- Bronchitis
- Respiratory infections.

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Preventing Mold Growth

Simple Steps

- keep exterior moisture out of the building
- control moisture from internal sources

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Preventing Mold Growth

- It's important to that conditions that require attention are identified and dealt with promptly.
- Action should be taken to detect and correct leaks, condensation problems, and floods as soon as they are discovered.
- The potential for building structural damage, mold growth, and increased adverse health effects can and should be reduced by limiting the buildup of indoor moisture.

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Top Ten Things To Know About Mold & Moisture

1. Potential health effects and symptoms associated with exposures to mold and excessive moisture include allergic reactions, asthma, and other respiratory complaints.
2. There is no practical way to eliminate all mold and mold spores in the indoor environment; the way to control indoor mold growth is to control moisture.
3. If mold is a problem in an apartment or building, we must clean up the mold and eliminate sources of moisture.
4. Fix the source of the water problem or leak to prevent mold growth, including repairing leaky roofs.



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Top Ten Things To Know About Mold & Moisture

5. Reduce indoor humidity (to 30-60%) to decrease mold growth by: venting bathrooms; using air conditioners and de-humidifiers; increasing ventilation; using exhaust fans whenever cooking, dishwashing, and cleaning.
6. Clean and dry any damp or wet building materials and furnishings within 24-48 hours to prevent mold growth.
7. Clean mold off hard surfaces with water and detergent, and dry completely. Absorbent materials, such as sheetrock, that are moldy may need to be replaced.



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Top Ten Things To Know About Mold & Moisture

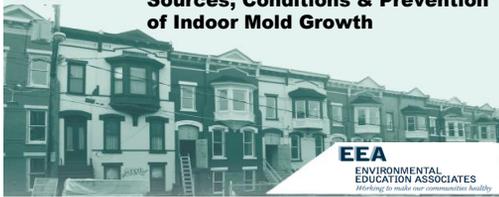
8. Prevent condensation: reduce the potential for condensation on cold surfaces such as piping by adding insulation.
9. If needed as a result of asthma, individuals with mold and/or moisture in their apartments are entitled to reasonable accommodations.
10. Molds can be found almost anywhere; they can grow on virtually any substance if moisture is present. For example, there are molds that can grow on wood, paper, carpet, and foods.



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NYSOL MOLD TRAINING

Sources, Conditions & Prevention of Indoor Mold Growth



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Indoor Air Quality

- Air pollution can penetrate the protective layer of our lungs and cause inflammation. This in turn can cause respiratory disease and symptoms such as chest pain and coughing, even among generally healthy individuals.
- Air pollution can impact the cardiovascular system, increasing the risk for heart attacks or blood clots
- High temperatures have been found to make these health outcomes even worse



2

Indoor Air Quality

Q: What's the average amount of dust an average home in the U.S. will collect in a year?



3

Indoor Air Quality

Q: What's the amount of dust the average amount a U.S. home will collect in a year?

A: 40 lbs



4

Indoor Air Quality

Air quality is influenced by:

- Temperature
- Humidity
- Air Movement
- Air Contaminants



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Temperature & Humidity

- Temperature
 - High temperatures have been found to enhance health outcomes
- Humidity
 - Mold spores, dust mites and other allergens survive best in high humidity environments.



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Air Movement

- Too little air flow causes stuffy and uncomfortable environment;
- May result from resident efforts to control pests, smells & other concerns
- Too much causes draught & excessive cold.
- Adequate ventilation is critical to drying moisture



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Airborne Contaminants

- Bioaerosols (mold spores) transported by wind, ventilation and host.
- Settle on host surfaces and reproduce
- Exposure caused by inhalation & ingestion

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Bioaerosols

are those airborne particles that are living or originate from living organisms. Bioaerosols include micro organisms (i.e, culturable, nonculturable, and dead micro organisms) and fragments, toxins, and particulate waste products from all varieties (species) of living things

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Airborne Particulates

- Bioaerosols make up a portion of total airborne particles.
- Smallest particles <1um
 - 99% of the number of particles
 - 3% of total mass of the particles

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Microbes



A group of extremely small life forms that are usually visible only with the aid of a microscope

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Unit of Measure

- Micron
 - A micron is a measurement equal to one millionth of a meter or 0.00003937
 - Human Hair = 75u
 - Human eye sees 50u

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Microbial Organisms

- Viruses
- Bacteria
- Fungi



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Viruses

Viruses are ultra small microbes (.03 to .25 microns).

- A unique characteristic of a virus is that it can only reproduce in a host organism.
- They can remain dormant or they can invade a cell, using it to reproduce additional virus.
- They can be extremely durable.

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Bacteria

Extremely small microbes (.4 to 10 microns).

- Bacteria are everywhere and are necessary to life.
- Some bacteria are saprophytic (feeding on non-living organisms) and others are parasitic (feeding on living organisms).
- In addition they can be aerobic or anaerobic (needing or not needing oxygen to survive).
- Many bacteria found in sewage can grow in low oxygen environments.

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Fungi

Simple, aerobic organisms

- unlike bacteria can grow in low moisture and low pH environments, and have their genetic material bound in a membrane
- unlike plants do not have roots or leaves, do not contain chlorophyll, and do not produce their own food, but obtain nourishment from dead organic matter.

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Fungi

Fungi can be divided into 3 groups;

- (1) yeasts,
 - (2) mushrooms and
 - (3) filamentous fungi (molds).
- Most molds consist of cells that are filamentous.
 - These cells, called hyphae, collectively form mycelium. Well established growth is referred to as colonization.
 - Molds generally reproduce by means of spores, but not all spores are viable.

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Common Uses for Fungi

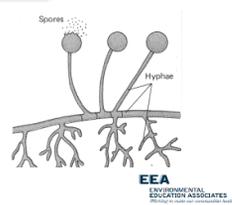
- Antibiotics and antifungal products
- Oral contraceptives and steroid production
- Soy Sauce, bread, beer and wine
- Cheese & dairy products
- Sausage and other food fermentation
- Used in fiber processing to enhance sheen & strength
- Paper production and more



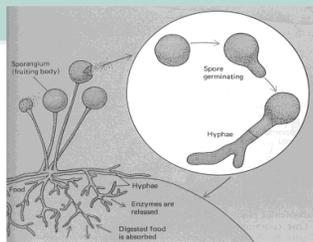
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Fungus Body Composition

- Hyphae – body filament
- Mycelium – mass of visible hyphae
- Spores – reproductive structures



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Fungi

- Fungi can produce a mycotoxin that will be present in the cell wall of the organism even if the organism is dead.
- Mycotoxins may cause adverse health effects



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mVOCs

- Microbial Volatile Organic Compounds
- The musty, moldy odors in water-damaged indoor environments are compounds produced by metabolically active bacteria and fungi. While health effects have not yet been attributed to MVOC exposures, their presences is an indicator of microbial contamination, and the need for proper remediation practices and the use of appropriate personal protective equipment.



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Microscopic View of Mold Body



[Types of Mold](#)



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Common Types of Mold

- **Alternaria** is often found outdoors, but it also grows in damp places indoors, like in showers or under sinks with leaky pipes. It can also be found in buildings that have been flooded or suffered other water damage. It spreads easily from one area of the home to another. Exposure to alternaria can cause allergic reactions and asthma attacks.
- **Aspergillus** is a type of mold frequently found indoors. It can cause allergic reactions, respiratory infections, and a condition called hypersensitivity pneumonitis, which causes inflammation of the lungs.
- **Aureobasidium** is a mold often found outdoors, but it can also be found in homes growing on wooden surfaces, wallpaper, and painted surfaces. It's also often found on damp window frames and caulking. It is pink and black in color. Many people are allergic to aureobasidium.
- **Bovine** grows in areas with high levels of humidity, like bathrooms with poor ventilation. It can cause allergic reactions and asthma.
- **Chaetomium** often grows on drywall that has sustained water damage. It produces a characteristic musty odor.

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Common Types of Mold

- **Cladosporium** is a type of mold often found growing inside homes. While most types of mold prefer warm climates, cladosporium can grow in cool areas, too. It often grows on fabrics, like carpets, and on wood surfaces, like cabinets and floorboards. It can cause a variety of respiratory problems.
- **Fusarium** is another of the mold types that, like cladosporium, can grow and spread at lower temperatures. It's often found growing on water-damaged carpeting and other fabrics. It causes allergic reactions, asthma, and respiratory infections. People with compromised immune systems are particularly vulnerable to infections due to fusarium exposure.
- **Penicillium** is often found growing on materials that have been damaged by water, including carpeting, wallpaper, insulation, and furnishings like mattresses. It's one of the mold types that spread quickly and easily from one part of the home to another. Exposure to penicillium can cause allergic reactions, [chronic sinus infections](#), and inflammation of the lungs. Usually appears as a [blue mold](#) and/or a [green mold](#).

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Common Types of Mold

Stachybotrys chartarum is often referred to as "black mold" due to its slimy black appearance. It's sometimes referred to as "toxic mold," although the mold itself is not toxic; it produces toxic compounds called mycotoxins, which cause health problems when people come in contact with them. It can cause allergic reactions, breathing problems, chronic sinus infections, asthma attacks, fatigue, and depression. *Stachybotrys chartarum* has a characteristic musty odor and usually grows in places that stay damp all the time, like in air conditioning ducts where there is a lot of condensation or around leaky pipes. Learn more about [black mold in homes](#).

Serpula lacrymans is a [yellow mold](#) that causes "dry rot" because it feeds on wood.

Trichoderma is often found growing on damp carpet, wallpaper, and other wet surfaces. It produces mycotoxins similar to those produced by *stachybotrys chartarum*, and it can cause similar health problems. Many people are also allergic to trichoderma.

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Common Types of Mold

Ulocladium requires a lot of water, so it frequently grows in areas with extensive water damage, including homes that have been flooded. It's often found growing on wet walls. Many people are allergic to ulocladium.

Efflorescence are salt deposits that are often confused with [white mold in basement](#).

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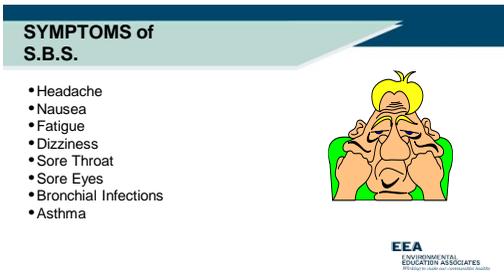
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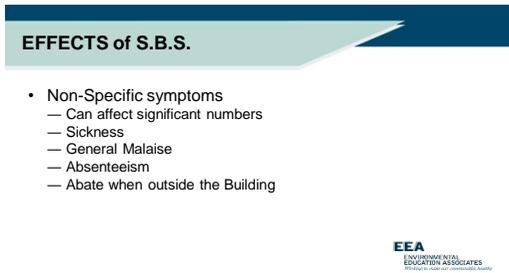
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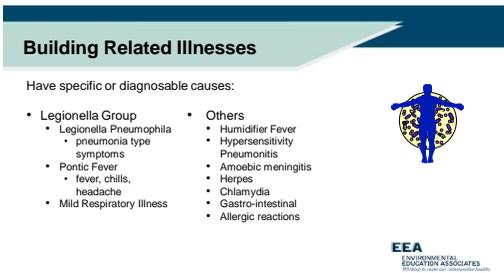
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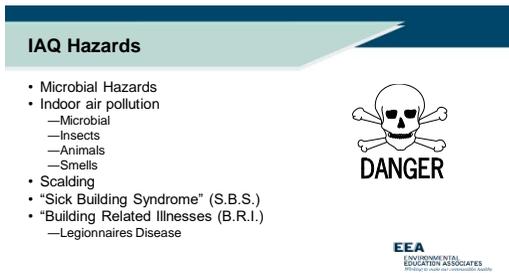
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Air Quality

Air quality is influenced by:

- Temperature;
- Humidity
- Air Movement
- Air Contaminants



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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
- Air Changes per Hour (A.C.H.) - A.S. 1668.2
 - 10 - 15 litres per second, per person is required
- Obtain expert advice:
 - Occupational Hygienist
 - Air Conditioning Engineer



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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



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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 mould
- Controls:
 - Air conditioning
 - admin controls - rostering for short periods
 - install dehumidification devices



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Air Handling & Water Systems (AS 3666)

Air-handling and water systems of buildings –

Microbial control (AS 3666-1989)

- Specifies minimum requirements for the design, installation, commissioning, operation, and maintenance of air-handling systems and water systems in buildings, to assist in the control of micro-organisms, particularly those associated with Legionnaires disease, Pontiac fever, humidifier fever, and hypersensitivity pneumonitis.
- It does not apply to sole occupancy dwellings, nor is it intended for the control of the wide range of discomfort symptoms which may afflict the occupants of some buildings.



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Prevention & Control Measures

- Engineering development & design
- Inspection, Testing & Maintenance
- Avoid development of contamination
- Safe operating procedures
- Cleanliness
- Biocides (?)



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Air Handling & Water Systems (AS 3666)

- Air handling plant
 - Cooling & ventilation systems
- Cooling Towers & Condensers
- Evaporative Coolers
- Hot Water Systems
- Warm Water Systems
- NOT Refrigerated Air Conditioning Systems



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Airborne Contaminants

- Carbon Dioxide (CO₂)
 - not usually regarded as a "pollutant" but affects general comfort
 - maintained below 1,000 PPM
- Combustion By-Products
 - carbon monoxide - interferes with oxygen transport in blood
 - oxides of nitrogen - irritate eyes & respiratory tract
 - a range of hydrocarbons
- Ozone - highly toxic
 - U.V. Light
 - ionisation
 - laser printers, photocopiers, ionisers
- Formaldehyde
 - eye & respiratory tract irritant - suspected human carcinogen
 - building materials - plywood, particle board, some carpets, foam insulation
- Other Volatile Organic Compounds (V.O.C.)
 - cosmetics, cleaning agents, waxes, carpets, paints, glues, furnishings



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More Airborne Contaminants

- Airborne Particles
 - combustion particles - cooking, heating
 - combustion particles - tobacco smoking
 - dusts from clothing, paper, carpets
 - fibers - asbestos, fiberglass
- Radon & Radon Products
 - certain rock & soil building materials - colorless gas
- Environmental Tobacco Smoke (E.T.S.)
 - "mainstream smoke" - burning cigarette
 - "sidestream smoke" - exhaled breath of smoker
- Microbial Pollutants
 - viruses, bacteria & fungi
 - cause infections & allergic reactions
 - dust mites
 - unpleasant odors



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Temperature

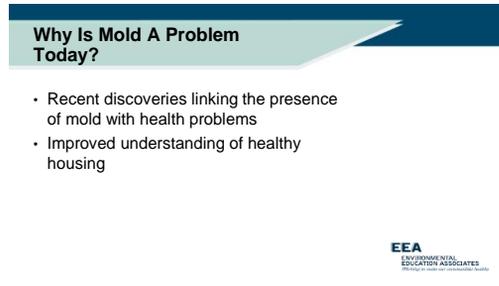
- Ideal temperature range is:
 - Summer - 22° - 24° C
 - Winter - 19° - 23° C
- Where outdoor shade temp exceeds 32° C, the indoor temp should be at least 6° C lower.
- Workers in hot climates should not be subjected to excessive heat stress conditions:
 - effect of solar heat load (sun shining on a workplace)
 - uneven distribution of solar heat load
 - nature of work being performed
 - clothing and PPE
 - different perceptions of thermal conditions & comfort
- Controls
 - adjustable air conditioning
 - reflective glass, screens, blinds, awnings, relocate work stations



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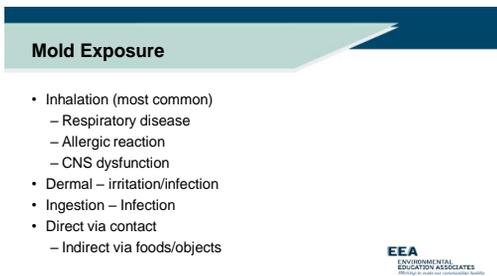
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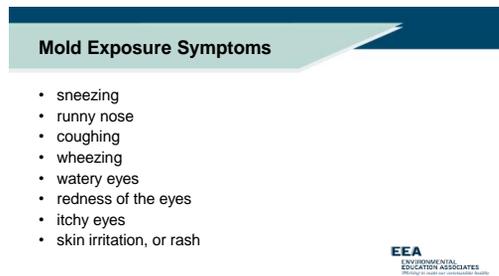
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Potential Health Effects

- Allergic reactions/disease
- Irritant effects
- Infections
- Toxic effects



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Allergic Responses

- Reactions can be immediate or delayed.
- Reactions can result from inhaling or touching mold or mold spores.
- Mold spores and fragments, whether dead or alive, can produce allergic reaction in sensitive individuals.
- Repeated or single exposure may cause previously non-sensitive individuals to become sensitive.
- Repeated exposure has the potential to increase sensitivity.

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Allergic Responses

Hay fever-type symptoms

- Sneezing
- Runny nose
- Red eyes
- Skin rash (dermatitis)

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Allergic Responses

Asthma

- Molds can trigger asthma attacks in persons allergic (sensitized) to molds.
- Asthma is a major problem in New York City. In some low-income parts of New York City, as many as one in four children have asthma.



[What is Asthma?](#)

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Allergic Responses

Hypersensitivity pneumonitis (HP)

- Rare, but serious, immune-related condition resembling bacterial pneumonia
- May develop after either acute or chronic exposure (via inhalation) to molds
- Usually related to occupational exposure
- Can also be caused by bacteria

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Less Common Allergic Syndromes

- Allergic bronchopulmonary aspergillosis
- Allergic fungal sinusitis

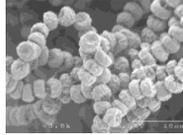
Note: There is no evidence to link exposures to fungi in home, school, or office settings to these particular conditions.

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Irritant Effects

- Irritation of:
 - Eyes
 - Skin
 - Nose
 - Throat
 - Lungs



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Irritant Effects

Mold exposure can irritate the eyes, skin, nose, throat, and lungs of both mold-allergic and non-allergic people.



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Toxic Reactions

- Some molds can produce toxic substances called mycotoxins.
- Some mycotoxins are on the surface of mold spores; others are within the spore.
- Over 200 mycotoxins have been identified from common molds.

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Mycotoxins

- Medical evidence of whether mold growing in homes or offices causes health effects in occupants due to mold toxins is lacking.
- * Research is needed.

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Microbial Volatile Organic Compounds (mVOCs)¹

- Produced by molds and released into air
- Often have strong and/or unpleasant odors
- Exposure linked to symptoms such as headaches, nasal irritation, dizziness, fatigue, nausea
- Health effects research in early stages

[Moldy](#)

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Degrees of Exposure

- **"The dose makes the poison"** (in [Latin: sola dosis facit venenum](#)) – Paracelsus (1538 AD)
- a substance can produce the harmful effect associated with its toxic properties only if it reaches a susceptible biological system within the body in a high enough concentration
- Occupants or remediation workers disturbing large areas of mold growth face greater exposure potential, and thus, greater potential for adverse health effects.



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Common-Sense Approach

- **Small amounts of mold growth in homes and buildings are common occurrences, that for the majority of people present minimal health risks.**
 - The solution is to fix the moisture problem and clean up the mold quickly.
- **Large areas of mold growth present a more likely risk of exposure and adverse health effects for some people.**
 - Large areas of mold growth indicate more extensive water damage/moisture intrusion in the building.
 - Additional and more extensive measures should be used during remediation to protect both workers and occupants of the building.



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Unknowns

- There are insufficient data to determine if molds cause other adverse health effects, such as pulmonary hemorrhage, memory loss, or lethargy.
- We do not know if the occurrence of mold-related illnesses is increasing.
- 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.



20

Health Issues for Workers

- 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.



21

Health Issues for Workers

- **During mold assessment & 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



22

Golden Rule for Mold Exposure Safety

Minimizing mold-related exposures will reduce the possibility of health impacts on occupants and workers.

- As the potential for exposure increases, the need for protective measures increases.
- Workers can reduce exposure potential by proper use of personal protective equipment (PPE).
 - Respirators (Minimum N-95)
 - Gloves
 - Protective clothing
 - Goggles



23

Dealing with the Public

- Do not give medical advice to residents.
- Tell them to consult a health care provider regarding any health effects they might be experiencing.



24

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.



6

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 NYSJDOL

- 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.



9

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.



10

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.



11

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.



12

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.



13

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.



14

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.



15

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.



16

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.



17

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.



18

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.



19

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.



20

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.



21

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.



22

Factsheet

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



23

Complaint Form

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



24

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



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 apprised 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 | Organic Peroxides |
| Gases | Toxic Materials |
| Flammable Liquids | Infectious Substances |
| Flammable Solids | Radioactive Materials |
| Oxidizers | 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



10

Toxic Materials

- Division 6.1 Toxic Materials
- Division 6.2 Infectious Substances



11

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



12

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.*

16

Safety Data Sheet

100 Data, April 2016

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: 100 Data, April 2016

Manufacturer: Environmental Education Associates, Inc.

Address: 100 Data, April 2016

Phone: 100 Data, April 2016

Section 2: Hazard Identification

Signal Word: DANGER

Hazard Statements: H302, H314, H332, H334

Precautionary Statements: P201, P202, P273, P301, P302, P303, P304, P305, P306, P307, P308, P309, P310, P312, P313, P314, P315, P321, P330, P331, P332, P333, P334, P335, P336, P337, P338, P339, P340, P341, P342, P343, P344, P345, P346, P347, P348, P349, P350, P351, P352, P353, P354, P355, P356, P357, P358, P359, P360, P361, P362, P363, P364, P365, P370, P371, P372, P373, P374, P375, P376, P377, P378, P379, P380, P381, P382, P383, P384, P385, P386, P387, P388, P389, P390, P391, P392, P393, P394, P395, P396, P397, P398, P399, P400, P401, P402, P403, P404, P405, P406, P407, P408, P409, P410, P411, P412, P413, P414, P415, P416, P417, P418, P419, P420, P421, P422, P423, P424, P425, P426, P427, P428, P429, P430, P431, P432, P433, P434, P435, P436, P437, P438, P439, P440, P441, P442, P443, P444, P445, P446, P447, P448, P449, P450, P451, P452, P453, P454, P455, P456, P457, P458, P459, P460, P461, P462, P463, P464, P465, P466, P467, P468, P469, P470, P471, P472, P473, P474, P475, P476, P477, P478, P479, P480, P481, P482, P483, P484, P485, P486, P487, P488, P489, P490, P491, P492, P493, P494, P495, P496, P497, P498, P499, P500, P501, P502, P503, P504, P505, P506, P507, P508, P509, P510, P511, P512, P513, P514, P515, P516, P517, P518, P519, P520, P521, P522, P523, P524, P525, P526, P527, P528, P529, P530, P531, P532, P533, P534, P535, P536, P537, P538, P539, P540, P541, P542, P543, P544, P545, P546, P547, P548, P549, P550, P551, P552, P553, P554, P555, P556, P557, P558, P559, P560, P561, P562, P563, P564, P565, P566, P567, P568, P569, P570, P571, P572, P573, P574, P575, P576, P577, P578, P579, P580, P581, P582, P583, P584, P585, P586, P587, P588, P589, P590, P591, P592, P593, P594, P595, P596, P597, P598, P599, P600, P601, P602, P603, P604, P605, P606, P607, P608, P609, P610, P611, P612, P613, P614, P615, P616, P617, P618, P619, P620, P621, P622, P623, P624, P625, P626, P627, P628, P629, P630, P631, P632, P633, P634, P635, P636, P637, P638, P639, P640, P641, P642, P643, P644, P645, P646, P647, P648, P649, P650, P651, P652, P653, P654, P655, P656, P657, P658, P659, P660, P661, P662, P663, P664, P665, P666, P667, P668, P669, P670, P671, P672, P673, P674, P675, P676, P677, P678, P679, P680, P681, P682, P683, P684, P685, P686, P687, P688, P689, P690, P691, P692, P693, P694, P695, P696, P697, P698, P699, P700, P701, P702, P703, P704, P705, P706, P707, P708, P709, P710, P711, P712, P713, P714, P715, P716, P717, P718, P719, P720, P721, P722, P723, P724, P725, P726, P727, P728, P729, P730, P731, P732, P733, P734, P735, P736, P737, P738, P739, P740, P741, P742, P743, P744, P745, P746, P747, P748, P749, P750, P751, P752, P753, P754, P755, P756, P757, P758, P759, P760, P761, P762, P763, P764, P765, P766, P767, P768, P769, P770, P771, P772, P773, P774, P775, P776, P777, P778, P779, P780, P781, P782, P783, P784, P785, P786, P787, P788, P789, P790, P791, P792, P793, P794, P795, P796, P797, P798, P799, P800, P801, P802, P803, P804, P805, P806, P807, P808, P809, P810, P811, P812, P813, P814, P815, P816, P817, P818, P819, P820, P821, P822, P823, P824, P825, P826, P827, P828, P829, P830, P831, P832, P833, P834, P835, P836, P837, P838, P839, P840, P841, P842, P843, P844, P845, P846, P847, P848, P849, P850, P851, P852, P853, P854, P855, P856, P857, P858, P859, P860, P861, P862, P863, P864, P865, P866, P867, P868, P869, P870, P871, P872, P873, P874, P875, P876, P877, P878, P879, P880, P881, P882, P883, P884, P885, P886, P887, P888, P889, P890, P891, P892, P893, P894, P895, P896, P897, P898, P899, P900, P901, P902, P903, P904, P905, P906, P907, P908, P909, P910, P911, P912, P913, P914, P915, P916, P917, P918, P919, P920, P921, P922, P923, P924, P925, P926, P927, P928, P929, P930, P931, P932, P933, P934, P935, P936, P937, P938, P939, P940, P941, P942, P943, P944, P945, P946, P947, P948, P949, P950, P951, P952, P953, P954, P955, P956, P957, P958, P959, P960, P961, P962, P963, P964, P965, P966, P967, P968, P969, P970, P971, P972, P973, P974, P975, P976, P977, P978, P979, P980, P981, P982, P983, P984, P985, P986, P987, P988, P989, P990, P991, P992, P993, P994, P995, P996, P997, P998, P999, P1000

Section 3: Composition of Information on Substances

Section 4: First Aid Measures

Section 5: Fire Fighting Measures

Section 6: Accidental Release Measures

Section 7: Handling and Storage

Section 8: Exposure Controls/Personal Protection

Section 9: Physical and Chemical Properties

Section 10: Stability and Reactivity

Section 11: Toxicological Information

Section 12: Ecological Information

Section 13: Disposal Considerations

Section 14: Transport Information

Section 15: Regulatory Information

Section 16: Other Information

Section 17: Additional Information

Section 18: Revision History

Section 19: Revision Date

Section 20: Revision Description

Section 21: Revision Number

Section 22: Revision Date

Section 23: Revision Description

Section 24: Revision Number

Section 25: Revision Date

Section 26: Revision Description

Section 27: Revision Number

Section 28: Revision Date

Section 29: Revision Description

17

Establish Employee Training

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.

18

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.



19

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.



20

Determination of Hazards and Personal Protective Equipment

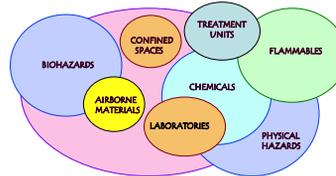
Job Hazard Analysis
Activity Hazard Analysis
Job Safety Analysis



21

Hazard Recognition

Look at the BIG picture!



22

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.



23

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.

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7

Protecting the Public

["Remediation Planning"](#) (video)

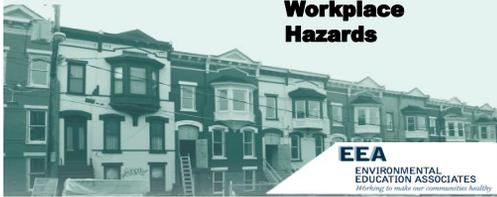


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8

NYSOL MOLD TRAINING

Workplace Hazards



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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

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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

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3

Work Place Hazards

OSHA's Hierarchy of Controls



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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



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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.



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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



7

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



8

Respiratory Protection

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



9

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."



10

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)



12

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"



14

Chemical Work Site Safety Hazards

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



15

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



18

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?



22

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!



23

Electrical Hazards

- Electrocutation 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



24

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



26

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



29

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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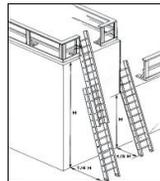
Summary – Cords & Wires

- 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



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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



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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



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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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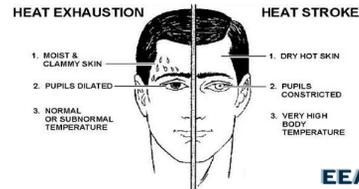
Problems With Heat

- 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 Stroke

- 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



53

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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Hazard Communication Plan Elements

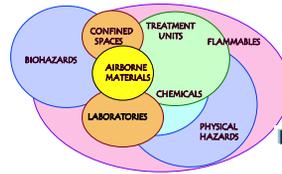
- Training for employees exposed to any hazardous chemicals in their work place must include:
- The requirements of the Federal Hazard Communication Standard and the New York State Right-to-Know Law.
- Information regarding the operations involving hazardous chemicals.
- The location and accessibility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



67

Hazard Recognition

Look at the BIG picture!



68

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 ?



69

Think Again!



70

Hazard Recognition

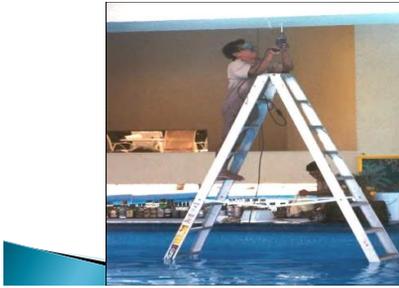
Most injuries shouldn't have happened!



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NYSODL MOLD TRAINING

Remediation Overview



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Remediation Overview

Remediation Planning



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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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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



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Engineering Controls

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

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Engineering Controls



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Fungicides & Disinfectants

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



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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

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Follow Manufacturer's Directions

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

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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.



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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.

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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

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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.



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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.



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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.



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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.



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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

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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.



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Preparing the Work Area

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



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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



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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



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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

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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



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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



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Isolation Barriers

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



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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.



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Installation of Wall Poly



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19

Work Area Prep

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



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NYSOL Mold Training

State of the Art Work Practices and New Technologies



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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)



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 - Safety issues
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 - Unstable



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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.



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Radiant Heat

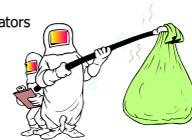
- Using heat to combat contaminants is a new idea but it is based on traditional scientific findings dating back to the 19th century, when Louis Pasteur proved that heat is an effective way to eliminate bacteria and other contaminants.
- This process, known as pasteurization, is a common technique in 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.



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Remediation Hygiene Practices

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



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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



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**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.
- 931. Licensing requirements.
- 932. License; procedure.
- 933. Exemptions.
- 934. License issuance and renewal.
- 935. Practice by license holder.
- 936. Licensee duties; prohibited activities.
- 937. Civil penalties and revocation.
- 938. Denial of license; complaints; notice of hearing.
- 939. Judicial review.
- 940. Rulemaking authority.

§ 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.
- 946. Minimum work standards for the conduct of mold remediation by licensed persons.
- 947. Post-remediation assessment and clearance.
- 948. Investigations and complaints.

§ 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

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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).

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 exposure⁸ 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:

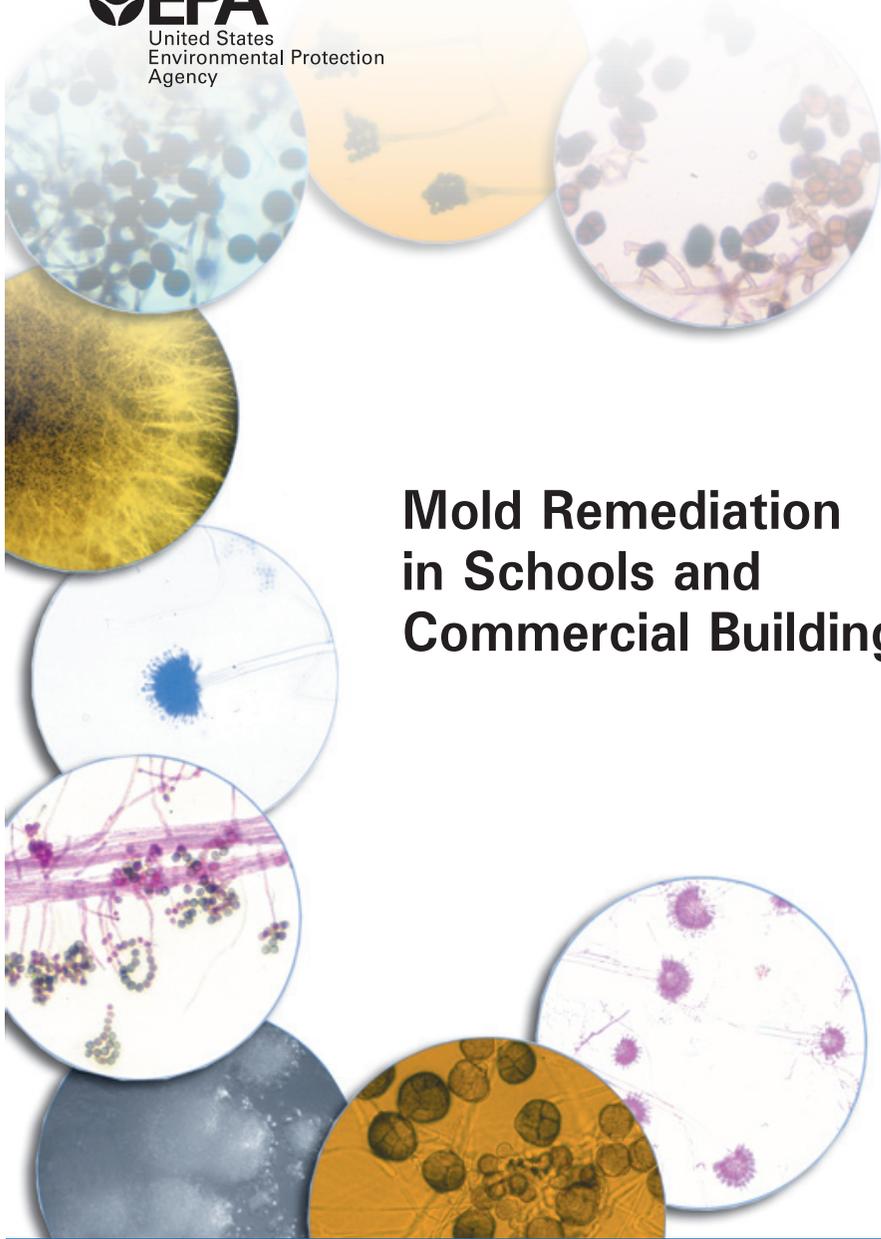
- Cover the floor in the work area with plastic sheeting.
- Cover entry and exit pathways with plastic sheeting.
- Seal any ventilation ducts with plastic sheeting.
- Mop and/or HEPA-vacuum the work area and pathways.

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 Guidelines”



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

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Introduction

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

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



Photo 2: Extensive mold contamination of ceiling and walls

¹If 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.

2 Mold Remediation in Schools and Commercial Buildings

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

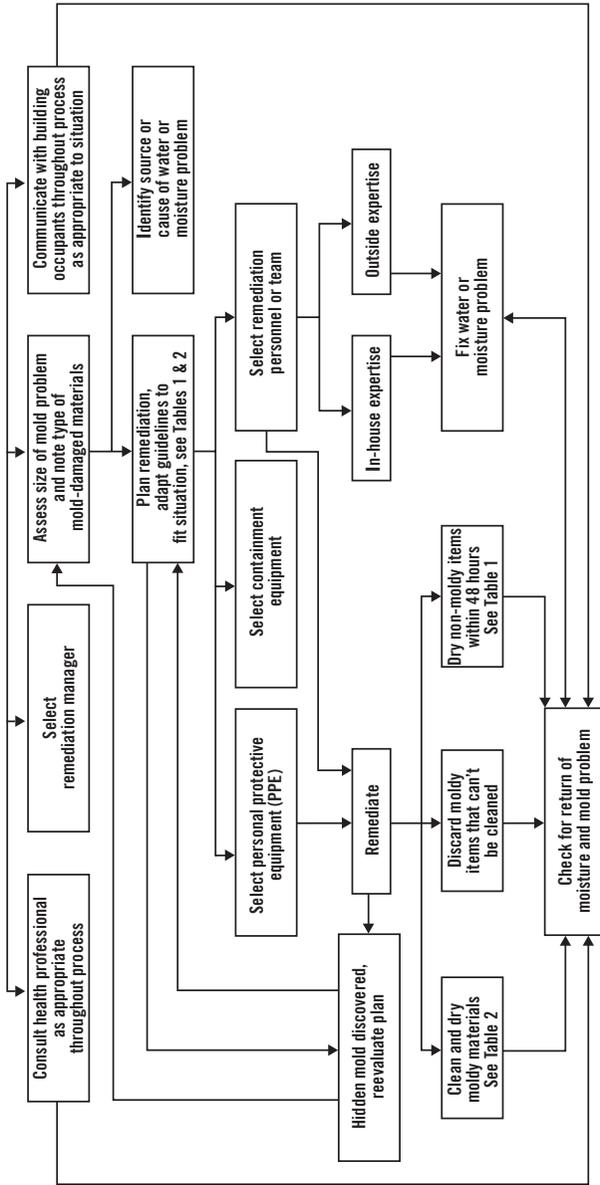


Photo 3A: Mold growing in closet as a result of condensation from room air



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

⁴Although 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

Hidden Mold Growth



Photo 5: Mold growth behind wallpaper

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.

⁵For 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 Prevention⁶

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.

⁶Please 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	<ul style="list-style-type: none"> * 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§	<ul style="list-style-type: none"> * Remove water with water extraction vacuum. * Reduce ambient humidity levels with dehumidifier. * Accelerate drying process with fans.
Ceiling tiles	<ul style="list-style-type: none"> * Discard and replace.
Cellulose insulation	<ul style="list-style-type: none"> * Discard and replace.
Concrete or cinder block surfaces	<ul style="list-style-type: none"> * Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters.
Fiberglass insulation	<ul style="list-style-type: none"> * Discard and replace.
Hard surface, porous flooring§ (Linoleum, ceramic tile, vinyl)	<ul style="list-style-type: none"> * 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)	<ul style="list-style-type: none"> * Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	<ul style="list-style-type: none"> * 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)	<ul style="list-style-type: none"> * 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	<ul style="list-style-type: none"> * Follow laundering or cleaning instructions recommended by the manufacturer.
Wood surfaces	<ul style="list-style-type: none"> * 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.
<p>*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.</p> <p>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.</p> <p>† If a particular item(s) has high monetary or sentimental value, you may wish to consult a restoration/water damage specialist.</p> <p>§ 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.</p>	

Table 2: Mold Remediation Guidelines⁷

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.

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.

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.

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 (ft²)			
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 (ft²)			
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 (ft²) 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).

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

Personal Protective Equipment



Photo 7: Remediation worker with limited PPE

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 (ft²) 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.

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.

Containment Area



Photo 8: Full containment on large job

Full Containment

Full containment is recommended for the cleanup of mold-contaminated surface areas greater than 100 ft² 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](http://www.epa.gov/iaq/pubs/occupgd.html)

www.epa.gov/iaq/pubs/occupgd.html

[Biological Contaminants](http://www.epa.gov/iaq/biologic.html)

www.epa.gov/iaq/biologic.html

[Building Air Quality Action Plan \(for Commercial Buildings\)](http://www.epa.gov/iaq/largebllds/pdf_files/baactionplan.pdf)

www.epa.gov/iaq/largebllds/pdf_files/baactionplan.pdf

[Floods / Flooding](http://www.epa.gov/iaq/flood)

www.epa.gov/iaq/flood

[Indoor Air Quality \(IAQ\) Home Page](http://www.epa.gov/iaq/index.html)

www.epa.gov/iaq/index.html

[IAQ in Large Buildings / Commercial Buildings](http://www.epa.gov/iaq/largebllds)

www.epa.gov/iaq/largebllds

[IAQ in Schools](http://www.epa.gov/iaq/schools)

www.epa.gov/iaq/schools

[Mold Remediation in Schools and Commercial Buildings](http://www.epa.gov/mold/mold_remediation.html)

www.epa.gov/mold/mold_remediation.html

[Mold Resources](http://www.epa.gov/mold/moldresources.html)

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 whatever they are growing on. Molds can grow on virtually any organic substance, providing moisture and oxygen are present. It is estimated that more than 1.5 million species of fungi exist.
Fungicide.....	Substance or chemical that kills fungi.
HEPA	High-Efficiency Particulate Air
Hypersensitivity	Great or excessive sensitivity
IAQ	Indoor Air Quality
Mold.....	Molds are a group of organisms that belong to the kingdom Fungi. In this document, the terms fungi and mold are used interchangeably. There are over 20,000 species of mold.

-
- mVOC.....Microbial volatile organic compound, a chemical made by a mold which may have a moldy or musty odor.
- OSHA.....Occupational Safety and Health Administration
- PAPR.....Powered air purifying respirator
- PPE.....Personal Protective Equipment
- RemediateFix
- Sensitization.....Repeated or single exposure to an allergen that results in the exposed individual becoming hypersensitive to the allergen.
- SporeMolds 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 B₁ 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 B₁ can cause liver cancer. There is also some evidence that inhalation of aflatoxin B₁ can cause lung cancer. Aflatoxin B₁ 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 pulmonary 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 pulmonary 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 β -(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 μm) 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.

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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.

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

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*.

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.

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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)

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>

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.
- 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.

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.

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>



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: _____

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 / 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	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> >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. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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 Packed 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 Packed 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.	