

City of Philadelphia

Mold Remediation, Water Damage and Use of Biocides

This document provides direction for remediation of building materials in City facilities with potential, visible or laboratory verified microbial growth caused by water damage. It also provides information on selection of biocides for mold remediation in the indoor environment.

There are several published documents available on the topic:

1. Bioaerosols: Assessment and Control, American Conference of Governmental Industrial Hygienists, 1999
2. Guidelines on Assessment and Remediation of Fungi in Indoor Environments, NY City Department of Health, April 2002 (updated version)
3. Mold Remediation in Schools and Commercial Buildings, EPA, Office of Air and Radiation, EPA 402-K-01-001, March 2001
4. IICRC S500, Standard and Reference Guide for Professional Water Damage Restoration, Institute of Inspection, Cleaning and Restoration, 1999

This document, as well as fungal remediation protocols (Table 1 and 2 in the Appendix A), are based on or adapted from the above documents.

Stages of Remediation Process

The fungal remediation process consists of the following basic elements:

1. Identifying and correcting the source of moisture and fungal contamination
2. Controlling the contaminated area to prevent spreading of fungi
3. Source removal of the fungi, contaminated dust, debris and other unwanted materials
4. Treating the affected areas with an antimicrobial chemical, if necessary.
5. Final cleaning with damp cloth or HEPA vacuum.
6. Clearance sampling, if necessary.

Please note, that treating the affected areas with the biocide is the last step in the actual remediation process. If previous three steps are not accomplished the use of biocide will not be effective and should not be recommended. Final cleaning and removal of organisms killed by the antimicrobial chemical is necessary to avoid potential occupational health concerns.

Specifications for Fungal Remediation are presented in the Appendix A (Tables 1 and 2).

Antimicrobial Chemicals

Antimicrobial pesticides (biocides) are substances used to control harmful microorganisms including bacteria, viruses or fungi on inanimate objects and surfaces primarily in indoor environments. Pesticides are identified in 6 classes by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Three of those classes that may have application to the mold remediation at the City Hall are detailed below:

1. **Disinfectants/Sanitizers/Sterilants¹** (kill bacteria, mold and mildew)
 - Bleach
 - Ammonia
 - Iodophors
 - Phenolic compounds
 - Other compounds
2. Insecticides (kill or repel insects, ticks, and mites)
3. Herbicides (kill weeds or unwanted plants)
4. **Fungicides** (kill mold, mildew and other fungi)
 - Paint additives to prevent mildew growth
5. Rodenticides (kill rodents such as mice and rats)
6. **Wood preservatives** (protect wood from insects and fungi)
 - Treated wood

¹ "Sanitizer" is a substance that significantly reduces the bacterial population in the inanimate environment, but does not destroy or eliminate all bacteria or other microorganisms.
"Disinfectant" is a substance that destroys or eliminates a specific species of infectious or other public health microorganism, but not necessarily bacterial spores, in the inanimate environment.
"Sterilant" is a substance that destroys or eliminates all forms of microbial life in the inanimate environment, including all forms of vegetative bacteria, bacterial spores, fungi, fungal spores, and viruses.

Only EPA registered² or approved biocides should be used for mold remediation at City facilities. All biocides can be identified by the presence of an Environmental Protection Agency (EPA) registration number (e.g., EPA Reg. No. 1234-567). By law, this number must be located on the product container or label of all pesticides (biocides). Before any product can be sold or used as a pesticide (biocide), the EPA reviews all appropriate data to ensure the product will not cause undue risk to people or the environment.

Precautions/Understanding the Label and Application of Biocides

The law requires that employees handling pesticides read and understand the label. Labels include information on active ingredients, their percentage, directions for use, precautions, information about first aid, information on storage and disposal, and classification statements (see Appendix B).

Trained personnel applying biocides should read and strictly follow the label. EPA registration permits the product as an antimicrobial only if used according to the approved label instructions.

Trained personnel (employees or contractors) should use the correct equipment and make sure it is properly maintained. Personnel should also wear the proper protective equipment (consult label and Tables 1 and 2 in Appendix A).

Always consult and coordinate any biocide application with the department/agency's Safety & Health Professional.

Routes of Exposure and Toxicological Information

There are three ways for toxic chemicals to enter the body:

- Inhalation
- Ingestion
- Absorption or penetration through skin and mucous membranes

All three ways can cause immediate danger.

If trained personnel choose to use biocides, they should always ventilate the area (see Tables 1 and 2 in Appendix A for details). 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. Personnel 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.

Do not use fungicides developed for use outdoors for mold remediation or for any other indoor situation.

The use of biocides must be considered toxic, and as such, exposure must be minimized as much as possible. Workers and building occupants must be protected from short- and long-term exposures (see Appendix A Tables 1 and 2 for details).

² Some biocides are exempted from the registration by the EPA and considered to be "minimum risk pesticides" (for the list of exempted pesticides see http://www.epa.gov/PR_Notices/pr2000-6.pdf)

The use of gaseous, vapor-phase, or aerosolized biocides for remedial purposes is not recommended. The use of biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space if used improperly. 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.

Effectiveness of Biocides

In order for the biocides to be effective, the surfaces to be treated must be first cleaned, then wetted with the biocide and allowed proper contact time of the biocide with the surface. After remediation services the surfaces should be dry. All surfaces must meet coverage and exposure criteria defined by the biocide manufacturer. The remediation firms should provide the means to insure and verify the results of sanitizing.

Some biocides can potentially damage some sensitive surfaces such as treated wood, paints, etc. It is therefore recommended to try biocides on small hidden surface areas before the application.

Clearance

Effectiveness of mold remediation can be evaluated based on the results of visual inspection or based on the results of clearance sampling. Clearance should be established as the final step of the remediation process (see Stages of Remediation Process). All affected surfaces should be dried and cleaned.

- Visual inspection should indicate all surfaces are dry and free from any visible signs of dust, debris, or fungal growth.
- Any clearance sampling should be based on culturable wipe sampling of the affected surfaces and should indicate total surface concentration of fungi less than 5,000 CFU (Colony Forming Units) /in². No pathogenic or highly allergenic species (such as, for example, *Stachybotrys atra*) should be detected.

Appendix A: Fungal Remediation Protocols

Table 1:
New York City Department of Health - Fungal Remediation Protocols

Remediation Parameter	Level 1	Level 2	Level 3	Level 4	Level 5	Level 5a
Description	Small Isolated Areas (10 sq. ft. or less)	Mid-Sized Isolated Areas (10-30 sq. ft.)	Large Isolated Areas (30-100 sq. ft.)	Extensive Contamination (Greater than 100 Contiguous sq. ft.)	HVAC Systems (<10 sq. ft.)	HVAC Systems (> 10 sq. ft.)
Examples	Ceiling Tiles, Small Areas on Wall	Individual Wallboard Panels	Several Wallboard Panels	Multiple Wallboard Panels	NA	NA
Minimum Requirement For Remediation Oversight	Trained Building Staff	Trained Building Staff	Qualified Health & Safety Professional	Qualified Health & Safety Professional	Trained Building Staff	Qualified Health & Safety Professional
OSHA Regulatory Standards	29 CFR 1910.1200	29 CFR 1910.1200	29 CFR 1910.1200	29 CFR 1910.1200	29 CFR 1910.1200	29 CFR 1910.1200
	29 CFR 1910.134	29 CFR 1910.134	29 CFR 1910.134	29 CFR 1910.134	29 CFR 1910.134	29 CFR 1910.134
Respiratory Protection	N95 Disposable Respirator	N95 Disposable Respirator	N95 Disposable Respirator	N95 Disposable Respirator	N95 Disposable Respirator	N95 Disposable Respirator
Gloves	Yes	Yes	Yes	Yes	Yes	Yes
Eye Protection	Yes	Yes	Yes	Yes	Yes	Yes
Protective Clothing	No	No	No	Yes	No	Yes
Remediation While Unoccupied	Yes	Yes	Yes	Yes	Yes	Yes
Vacation of Adjacent Spaces	Recommended if Occupied by Susceptible Groups*	Recommended if Occupied by Susceptible Groups*	Yes	Recommended if Occupied by Susceptible Groups*	Recommended if Occupied by Susceptible Groups*	Recommended if Occupied by Susceptible Groups*

Remediation Parameter	Level 1	Level 2	Level 3	Level 4	Level 5	Level 5a
Containment Required	No	Critical Barriers	Critical Barriers	Critical Barriers, Airlocks, Decontamination Room within Critical Barriers	Critical Barriers	Critical Barriers, Airlocks, Decontamination Room if > 30 sq. ft.
HEPA Filtered Negative Air	No	No	No	Yes	No	Yes
Dust Suppression	Misting	Misting	Misting	Misting	Misting	Misting
Bag Contaminated Materials	Yes	Yes	Yes	Yes	Yes	Yes
Post Remediation Cleaning of Work Areas and Egress	Clean with Damp Cloth and/or Mop with Detergent solution & Biocide	HEPA Vacuum & Clean with Damp Cloth and/or Mop with Detergent Solution & Biocide	HEPA Vacuum & Clean with Damp Cloth and/or Mop with Detergent Solution & Biocide	HEPA Vacuum & Clean with Damp Cloth and/or Mop with Detergent Solution & Biocide	HEPA Vacuum & Clean with Damp Cloth and/or Mop with Detergent Solution & Biocide	HEPA Vacuum & Clean with Damp Cloth and/or Mop with Detergent Solution & Biocide
Clearance Testing	No	No	No	Yes	No	Yes
* Susceptible groups include infants less than 12-months old, persons recovering from recent surgery, immune suppressed people or people with chronic inflammatory lung disease (i.e. asthma, hypersensitivity pneumonitis and severe allergies). NA – Not Applicable						

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

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

Material or Furnishing Affected	Cleanup Methods†	Personal Protective Equipment	Containment
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)			

Appendix B – Pesticide Labels

Pesticide labels carry one of three precautionary words or phrases. The products most toxic to humans will be labeled

“DANGER-POISON”

and display a skull and crossbones. Only a few drops could cause severe burns, serious health problems, or even death. Products labeled

“WARNING”

are less toxic to humans, but extreme care must be exercised in their use, particularly before they are diluted. These products, however, can still cause serious injury or health problems, or even death. The least toxic pesticides carry the message

“CAUTION”

The precaution portion of the labels will give additional advice on the safe use of the product. It might require that people and animals be kept out of treated areas, that the product not be used in enclosed areas, that special clothing and protective equipment be worn, etc.

For example:

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS

- Caution: Harmful if swallowed. Wash thoroughly with soap and water after handling. Avoid contact with eyes. Harmful if inhaled. Avoid breathing spray mist. Remove contaminated clothing and wash clothing before reuse.
- Physical Hazards: Flammable. Contents under pressure. Keep away from heat, sparks and open flame. Do not puncture or incinerate container. Exposure to temperatures above 130°F may cause bursting.