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**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
CENTRAL SERVICE AREA**

SPECIFICATION FOR

**Microbiological Remediation and
Restoration**

**Airport Traffic Control Tower
Kansas City International Airport
Kansas City, Missouri**

**MICROBIOLOGICAL REMEDIATION AND RESTORATION
AIRPORT TRAFFIC CONTROL TOWER
KANSAS CITY INTERNATIONAL AIRPORT
KANSAS CITY, MISSOURI**

The following documents and attachments in combination define the scope of work and requirements for the performance of work on this project.

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Introduction: The following specification and advisements constitute the working portion of the contract between the Contractor and the Federal Aviation Administration (FAA), an Agency of the United States Government. The Contracting Officer (CO) assigned to this contract shall be the only individual with authority to speak for and contractually bind the FAA. All communications, authorizations, approvals, changes, modifications, etc. involving this contract shall be through the Contracting Officer. Any action not approved by the Contracting Officer shall not bind the FAA.

Contracting Officer's Technical Representative (COTR): The Contracting Officer may assign a COTR to monitor the work being performed on this project and act as a technical point of contact. A letter detailing the COTR's responsibilities and authority will be issued when a COTR is assigned.

STATEMENT OF WORK

MICROBIOLOGICAL REMEDIATION

FOR

FEDERAL AVIATION ADMINISTRATION

KANSAS CITY AIRPORT TRAFFIC CONTROL TOWER (MCI ATCT)

KANSAS CITY, MISSOURI

- 1.0 WORK SUMMARY.** The Contractor is required to furnish all labor, materials, services, equipment, insurance, and perform all the work to remove and dispose of all microbiological contaminated materials (MCM) and microbiological contaminated elements (MCE) described in this scope of work. The Contractor shall be responsible for the cleanup and removal of microbiological contaminated gypsum board, shaft liner, insulation, and pipe insulation in the MCI ATCT Cab Level stairs, Rooms SJ1, 11TS5, 11TS5A, 11TS6, 11th Floor Outer Ring, 10TS4, 10TS5, 8TS1, 8TS5, 8TS6, 4TS3, 3TS3, 3TS5, 2TS5, and G4 in accordance with the guidelines established by the New York City Department of Health entitled *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (GARFIE) attached and incorporated herein by reference (See Attachment 1). Included in the scope of work is the removal of any MCM between the bottom metal runner/track and the concrete floor; between the top metal runner/track and the structural deck; and between the metal stud and exterior concrete wall. The Contractor shall minimize dust generation and use the methodologies outlined in GARFIE for dust prevention and suppression. Prior to performing microbiological remediation procedures, the Contractor shall seal all critical penetrations and openings to the work area with a minimum of 2-layers of 6-mil polyethylene, and shall be responsible for ensuring adjoining areas are not exposed to the microbial contamination during the remediation. The Contractor shall provide additional cleaning procedures as described herein in the ASDE Level, Cab Level, Junction Level, Subjunction Level, Rooms SJ6 and SJ8, Level 2, Ground Level, Base Building link, elevator shaft, and elevator corridors and stairwells. A complete list of the work required is included in Section 7.0 Work Procedure and the Supplemental Statement of Work. All removals and other cleaning procedures conducted in the ASDE Level, Cab Level and stairs, Junction Level, SJ6, SJ8, 2TS5, 2TS1, 1TS1, and Base Building link shall be conducted at night between the hours of 10:00 PM and 6:00 AM. Cleaning procedures specified for the Subjunction Level shall be conducted between the hours of 10:00 PM and 6:00 AM. Work in the elevator shaft shall be conducted between the hours of 9:00 PM and 6:00 AM. Work in the elevator shaft shall be further restricted to allow for FAA use of the elevator as defined in the Supplemental Statement of Work. Negative air pressure equipment shall be equipped with a HEPA filter and discharged outside of the building whenever possible, otherwise discharged through a second HEPA filter in order to permit recirculation of air inside the building. See the Supplemental Statement of Work (SSOW) for additional work required to perform the remediation work and to restore the facility.

- 1.1. **CONTRACTOR'S RESPONSIBILITY.** The Contractor shall perform all work required to give a complete and satisfactory job as required by this statement of work. The Contractor shall be responsible for performing this scope of work in accordance with GARFIE. The Contractor shall perform the work per the schedule and sequence identified in the SSOW (Section 1.1). The Contractor shall be responsible for all debris generated under this contract at the job site and during transport of microbiological containing or contaminated materials to an approved disposal site.
- 1.1.1 **Site Visit.** The Contractor is responsible for inspecting the work space and field verifying all quantities for: constructing a negative pressure enclosure for each phase of the work, MCM, MCE removal and disposal, work area physical parameters, access limitations, and Government phasing limitations. The Contractor shall be required to work around existing furniture, fixtures and finishes during the performance of this contract. The site visit shall be scheduled by the Government for interested microbiological remediation Contractors to identify specific work area and phasing requirements.
- 1.1.2 **Property Damage.** The Contractor shall take all precautions to avoid damage to Government property or equipment. Any damage to Government property or equipment by the Contractor shall be repaired by the Contractor to its original state or better condition at no additional expense to the Government.
- 1.1.3 **Working Conditions.** Portions of the ATCT will be occupied and Government operations will continue on a normal, temporary, or restricted basis for the duration of the project. The Contractor shall take all precautions to ensure that their operations are conducted in a manner that does not interfere with the normal operations of the surrounding facilities and the safety and health of the occupants or the environment. Contractor's personnel will have limited access to the facility.
- 1.1.4 **Cleanup.** Upon completion of the work at the site, all staging and debris from the project shall be removed from the site and disposed of properly. The entire area shall be left clean and acceptable to the Government.
- 1.1.5 **Certifications.** The Contractor shall be certified by the Indoor Air Quality Association (IAQA), the Institute of Inspection, Cleaning and Restoration Certification (IICRC), the National Duct Cleaning Association (NADCA), or equivalent.
- 1.2. **SCHEDULE.** See contract documents for duration of contract and notice to proceed.
- 1.2.1 **Pre-Construction Meeting.** The Contractor shall attend a mandatory pre-construction meeting before starting work and the Government will schedule the meeting.

1.3. **TEMPORARY FACILITIES AND STAGING AREA.** The electrical energy and the water consumed shall be provided by the Government at no cost to the Contractor from existing lines and sources located in the ATCT or Base Building or from services adjacent to the work areas. Contractor's use of utilities shall be coordinated with the Government. Contractor is responsible for ensuring that adequate electrical power and water are available to complete the work. The Contractor will be permitted to use the areas as directed by the Government for staging and storage of materials. The area is restricted to uncontaminated work equipment and supplies. The area shall be left clean and restored to the same condition as when accepted by the Contractor.

1.4. **SUBMITTAL REQUIREMENTS.** The Contractor will submit the following materials to the Government for review and approval prior to starting work:

- Materials Safety Data Sheets for all chemical products.
- Respiratory Fit Test and Medical Surveillance for employees scheduled for this project.
- Negative Air HEPA Filtration Equipment Specification Sheet.
- HEPA Vacuum Specification Sheet.
- Proposed Phasing Schedule.
- Configuration of typical negative pressure enclosure system and location for each phase.

2.0 **MEDICAL REQUIREMENTS.** Contractor shall provide medical surveillance and have a written Respiratory Protection program in place as required by 29 CFR 1910.134 for all personnel engaged in the removal and demolition of MCM and MCE. Respirators and filters provided shall be NIOSH approved and provide the appropriate level of protection.

3.0 **PROTECTIVE CLOTHING.** Contractor shall provide workers and government representatives with sufficient sets of protective full body clothing. Such clothing shall consist of full body coveralls including head covers, foot covers and hand covers. Contractor shall provide additional personal protective safety equipment as required by applicable OSHA safety regulations.

4.0 **REMEDICATION AREA.** Contractor shall establish a remediation area and restrict the access to the microbiological work areas during work conducted in the ATCT. Contractor shall establish a roped-off perimeter and provide warning barrier tape and signs outside the perimeter of the negative pressure enclosure system. Contractor shall establish a negative pressure enclosure system by sealing all critical penetrations or openings to the work area with a minimum of two layers of six-mil polyethylene. Negative pressure enclosures shall have a minimum of four air exchanges per hour and shall be maintained and recorded with a magnehelic gauge or equivalent device under a minimum negative pressure differential of -0.02 inches of water relative to adjacent non-work area space. Negative air pressure equipment shall be equipped with a HEPA filter and exhaust shall be discharged outside the building, a minimum of 25 feet from building access points and building make-up air sources, or wherever necessary, negative air pressure equipment shall be equipped with a

HEPA filter and exhaust shall be discharged through a second HEPA filter in order to permit recirculation of air inside the building. Personnel shall wear and utilize protective clothing and equipment in the remediation area as specified herein.

5.0 DECONTAMINATION AREA. Contractor shall establish a decontamination unit for passage to and from the work area during remediation operations in order to minimize the leakage of mold-contaminated dust to the outside. This unit shall consist of a minimum of two chambers, including a clean room and equipment room separated by airlocks. The airlocks shall be formed by overlapping three sheets of 6-mil polyethylene sheeting at the exit of one room and three sheets at the entrance to the next room, with three feet of space between the barriers. Airlocks shall be constructed to effectively maintain negative pressure while not inhibiting worker egress in an emergency situation.

6.0 WORKER PROTECTION PROCEDURE.

- 6.1. Each worker and authorized visitor shall, upon entering the job site, put on appropriate respirator and clean protective clothing, before entering the work area.
- 6.2. Each worker and authorized visitor shall remove gross contamination from clothing by HEPA vacuuming, prior to leaving the remediation work area. After decontamination of protective clothing, while still wearing the respirator, remove protective clothing and dispose as microbiological waste, as appropriate, in a drum or 2-layers of 6-mil polyethylene disposal bags.
- 6.3. Workers shall not eat, drink, smoke, or chew gum or tobacco at the work site. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of MCM or MCE and until final cleanup is completed.

7.0 WORK PROCEDURE.

- 7.1. Moisture damage restoration and mold remediation shall be conducted as necessary and as described in the Cab Level stairs, Rooms SJ1, 11TS5, 11TS5A, 11TS6, 11th Floor Outer Ring, 10TS4, 10TS5, 8TS1, 8TS5, 8TS6, 4TS3, 3TS3, 3TS5, 2TS5, and G4.
- 7.2. Prior to performing microbiological remediation procedures, the Contractor shall seal all critical penetrations and openings to the work area. Establish phasing schedule with Government for each days work activity. Contractor shall HEPA-vacuum and/or wet wipe with a detergent solution all non-porous furniture and fixtures. Contractor will remove any furnishings from the remediation area, after it has been pre-cleaned. Upon completion, the Contractor will return the furnishings to the original location. If necessary, furnishings can be pre-cleaned and wrapped with 2 layers of 6-mil polyethylene and allowed to remain in the remediation area. Electrical equipment that poses an electrical hazard shall be HEPA vacuumed only.
- 7.3. Maintain a minimum of four air exchanges per hour within the remediation work area and a minimum negative pressure differential of -0.02 inches of water, continuously recorded by use of a magnehelic guage or equivalent device.

Negative air pressure equipment shall be equipped with a HEPA filter and discharged outside of the building whenever possible, otherwise discharged through a second HEPA filter in order to permit recirculation of air inside the building. Contractor will secure entrance into the regulated area at the conclusion of each workday.

- 7.4. The walls undergoing remediation are fire rated partitions and have multiple layers of fire resistant gypsum board on each face unless otherwise indicated. See floor plans and the sheet "PARTITION TYPES" in the appendix of the SSOW for details of the wall construction in each area. Removal limits shall coincide with existing metal studs at or beyond the limits identified below. Joints between gypsum board on the surface and concealed layer shall be staggered horizontally and vertically, unless limits are the entire wall and less than the length of gypsum board utilized. The shaft liner panels are 1" thick fire resistant gypsum board. Demolition work shall be conducted utilizing methods to minimize noise and the spread of dust, such as the use of HEPA vacuums at the point of cutting and/or tools with shrouds or boots connected to a HEPA vacuum. See SSOW for additional requirements. The locations and approximate quantities for gypsum board remediation are listed below:

Gypsum board and insulation totaling approximately four square feet will be removed from the Cab Level stairs at the walkway door. This area includes the portion west of the door, from frame to corner bead, 12" wide to a height of 18" and the portion east of the door, from frame to the north, a minimum of 2' wide to a height of 18".

Gypsum board totaling approximately twenty square feet will be removed from the Cab stairs. This area includes the water stained portion on the sloped ceiling section directly beneath the sink, 38" wide to a height of 6'2".

Gypsum board, shaft liner, and insulation totaling approximately 611 square feet will be removed from the Subjunction Level Equipment Room SJ1. On the west wall, this area begins at the southwest corner of the room extending northward, 15' to a height of 12' (surface layer), 13' wide to a height of 12' (concealed layer), and approximately 50% of the shaft liner on the entire west and northwest walls (an area equal to 20' wide to a height of 12'). Opening of the west wall will allow for a closer evaluation of the concealed layer and shaft liner behind the perimeter walls. The Contractor shall install temporary walk boards between the precast panels and perimeter walls on the east, north, and west sides to allow inspection of the shaft liner. See Supplemental Statement of Work for additional details. Subsequent necessary removal limits shall be determined accordingly. In the absence of any contamination, the surfaces behind the cove base on the north wall shall be wet wiped and scrubbed with a concentrated Sporidicin disinfectant solution. On the south wall, this area begins on the west side of the door of Mechanical Room SJ7 to the southwest corner of the room, 10' wide to a height of approximately 3' to the bottom of the door of Room SJ8 (surface layer) and 2' wide to a height of 2.5' (concealed layer). Contractor shall

HEPA-vacuum and/or wet wipe with a concentrated Sporidicin disinfectant solution all surfaces below raised flooring, including concrete floor, raised floor system, cables, conduit, etc. upon completion of remediation.

Gypsum board and insulation totaling approximately 126 square feet will be removed from 11TS5 and 11TS5A. In 11TS5, on the west wall, this area includes the southwest corner of the room, 3.5' wide to a height of 3' (surface layer) and 2.25' wide to a height of 30" (concealed layer). On the south wall, this area includes the southeast corner of the room to the door, 3.5' wide to a height of 42". On the east wall, this area includes the southeast corner of the room to the door to 11TS5A, 10.5' wide to a height of 4' (surface layer) and 10.5' wide to a height of 42" (concealed layer). In 11TS5A, on the west wall, this area includes the portion between the door to 11TS5 and the northwest corner of the elevator shaft, 30" wide to a height of 4' (surface layer) and 30" wide to a height of 42" (concealed layer).

Gypsum board, and insulation totaling approximately 18 square feet will be removed from 11TS6. On the west wall, this area begins in the southwest corner extending northward, 4' wide to a height of 18" (surface layer) and 32" wide to a height of 12" (concealed layer). On the south wall, this area begins in the southwest corner extending to the east wall, 3'7" wide to a height of 18" (surface layer) and 3'7" wide to a height of 12" (concealed layer).

Gypsum board, debris, and fire safing insulation will be removed from the 11th Floor Outer Ring. The Contractor shall visually estimate the approximate quantity. This area includes the void between the edge of the floor slab, precast exterior walls, and perimeter fire rated gypsum board walls.

Gypsum board, shaft liner, and insulation totaling approximately 415 square feet will be removed from 10TS5. On the north wall, this area extends from the east wall (between 10TS5 and 10TS4) to the west column enclosure, 18.2' wide to a height of 6' (surface layer), 18.2' wide to a height of 5' (concealed layer), and includes up to 5 pieces of shaft liner, each 2' wide to a height of 5'. On the northwest column enclosure, this area includes the east side, 3'6" wide to a height of 6' (surface layer) and 3'6" wide to a height of 5' (concealed layer). On the south wall, this area includes the portion north of the elevator shaft from the east wall to the northwest corner, 9'8" wide to a height of 4' (surface layer) and 9'8" wide to a height of 2' (concealed layer). On the east walls, these areas include the entire portion west of the elevator shaft, 7'10" to a height of 4' (surface layer) and 7'10" wide to a height of 2' (concealed layer); and the entire portion between 10TS5 and 10TS4, 7'3" wide to a height of 2' (surface layer) and 7'3" wide to a height of 1' (concealed layer).

Gypsum board and insulation totaling approximately 33 square feet will be removed from 10TS4. On the south wall, this area includes the portion between the door and the east wall, 3' wide to a height of 4' (surface layer) and 3' wide to a height of 2' (concealed layer). On the east wall, this area includes the portion from

the column enclosure in the corner southward, 4'10" wide to a height of 2' (surface layer) and 3'6" wide to a height of 18" (concealed layer).

Gypsum board totaling approximately 39 square feet will be removed from the area above the ceiling of 8TS1. See Supplemental Statement of Work for an access door to be installed for access to this area. On the south wall, the area includes the stained portion above the horizontal beam in the unfinished space above the ceiling, 6' wide to a height of 4' (surface layer) and 5' wide to a height of 3' (concealed layer).

Gypsum board totaling approximately 31 square feet will be removed from the area above the ceiling of 8TS6. On the west wall, this area includes the stained portion, which intersects the south wall of 8TS1 in the unfinished space above the ceiling, 4' wide to a height of 5' (surface layer) and 32" wide to a height of 4' (concealed layer). Remove additional gypsum board on the north wall to provide space to pass materials through the wall into the space above the ceiling of 8TS1.

Gypsum board totaling approximately 11 square feet will be removed from 4TS3. On the north wall, this area includes the portion between the door and the east precast wall, 34" wide to a height of 2' (surface layer) and 34" wide to a height of 18" (concealed layer).

Gypsum board totaling approximately 77 square feet will be removed from 3TS3. On the east wall, this area includes the entire portion, 9'7" wide to a height of 8'.

Gypsum board totaling approximately 213 square feet will be removed from 3TS5. On the north wall, this area includes the entire portion, 19' wide to a height of 3'. On the northwest wall, this area includes the entire portion, 3'4" wide to a height of 3'. On the west wall, this area includes the entire portion, 12'1" wide to a height of 3'. On the east walls, these areas include both portions, 14'4" wide to a height of 3' (surface layer) and 14'4" wide to a height of 2' (concealed layer). On the south wall adjacent to corridor 3TS1, these areas include the portion on both sides of the door, 8' wide to a height of 3'9". On the south wall adjacent to the elevator shaft, gypsum board removal will occur with fire pump panels left in place. This area includes a portion 10' wide to a height of 6" (surface layer) and 10' wide to a height of 4" (concealed layer). Remove additional gypsum board if contaminated on the east and west ends of fixed equipment to a height of 36" (surface layer) and to a height of 30" (concealed layer).

Gypsum board totaling approximately 13 square feet will be removed from 2TS5. On the north wall, this area extends from the northeast corner, 6.5' wide to a height of 2'.

Water stained gypsum board totaling approximately 14 square feet will be removed from G4. On the west wall, this area includes the portion of gypsum board covering rigid insulation beneath the outside air duct.

- 7.5. In the Cab Level stairs at the walkway door, Room SJ1 (west and south walls), 11TS5 (south and east walls), 11TS5A, 11th Floor Outer Ring, 10TS5, and 3TS5, a containment and negative pressure enclosure system shall be established as described in Section 4.0 Remediation Area. In Room SJ1 (west and south walls), 11TS5 (south and east walls), 11TS5A, 11th Floor Outer Ring, 10TS5, and 3TS5, a decontamination unit shall be established as described in Section 5.0 Decontamination.
- 7.6. In Rooms 11TS5 (west wall), 11TS6 (south and west walls), 10TS4 (south and east walls), 8TS1, 8TS6, 4TS3, 3TS3, and 2TS5, the work area shall be unoccupied, however, a containment and negative pressure enclosure system are not required. Prior to remediation, the work area shall be misted. Upon completion, the work area shall be HEPA vacuumed and then wet wiped with a detergent solution.
- 7.7. In the 11th Floor Outer Ring, the negative air machine and critical barrier shall be located in the corridor adjacent to the access panel. Prior to remediation, the work area shall be misted. Upon completion, the void shall be HEPA vacuumed. The ledge, created by the protruding sloped precast panel, and the walls, to a height of 4' above the ledge, shall be HEPA vacuumed and wet wiped with a detergent solution.
- 7.8. In Room G4, the work area shall be unoccupied, however, a containment and negative pressure enclosure system are not required. Prior to remediation, the work area shall be misted. Upon completion, the work area shall be HEPA vacuumed and then wet wiped with a detergent solution.
- 7.9. In the Cab Level stairs, the entire water stained area below the contaminated gypsum board shall first be covered and sealed with two layers of 6-mil polyethylene sheeting to contain dust and debris. From under the sink, the visibly mold-contaminated area shall then be misted, sealed with sheeting, and be cut out and removed, followed by HEPA vacuuming and wet wiping with a detergent solution. Upon completion, the remainder of the gypsum board on the sloped ceiling section shall be removed.
- 7.10. In the elevator shaft, the mold-contaminated area totaling less than 10 square feet shall be pre-cleaned by wet wiping with a detergent solution. This area includes a band, up to 2' in height, on the north, west, and south walls, approximately ten feet below the 9th Floor slab elevation. After being allowed to dry, the entire shaft shall be wet wiped again with a detergent solution. The Contractor shall be responsible for contracting with the existing elevator maintenance contractor regarding procedures for use of the elevator car to perform the work required in the elevator shaft required by this Statement of Work. See SSOW for requirements.

In Room 8TS5, gypsum board totaling approximately 26 square feet will be removed. This area includes the portion on the south wall beginning at the northwest corner and extending to the east, 6' wide to a height of 3' (surface layer) and 4' wide to a height of 2' (concealed layer). The opening shall be centered

approximately 13'6" above floor finish to coincide with the location of the mold found on the shaft liner panel in the elevator shaft.

- 7.11. In Rooms SJ6 and SJ8, floors shall be HEPA vacuumed and then wet wiped with a detergent solution. Metal walls shall be wet wiped with a detergent solution. Prior to vacuuming floor in Room SJ8, the air intake opening shall be sealed with 2 layers of 6-mil polyethylene sheeting.
- 7.12. In the Cab Level, Junction Level, Subjunction Level, Level 2, Ground Level, the Base Building link and stairwells, all supply air diffusers or registers, return air grilles, and exhaust grilles shall be HEPA vacuumed and then wet wiped with a detergent solution. All ceiling mounted speaker covers shall be HEPA vacuumed.
- 7.13. In the Subjunction Level Room SJ1, the gypsum board enclosing the steel bracing in the northwest and northeast corners shall be HEPA vacuumed and then wet wiped with a detergent solution.
- 7.14. In the stairwells, all stair stringers, window ledges, window frames, gypsum board caps, and walls where visible dust is present shall be HEPA vacuumed and then wet wiped with a detergent solution. All remaining surfaces shall be wet wiped with a detergent solution.
- 7.15. In the elevator corridors, recessed areas around the elevator door shall be HEPA vacuumed and then wet wiped with a detergent solution. This area includes the TS1 Rooms between Level 3 and the Junction Level. All remaining surfaces shall be wet wiped with a detergent solution.
- 7.16. In the ASDE Penthouse and ASDE Vestibule, all insulated metal panel (IMP) walls shall wet wiped with a detergent solution or equivalent to clean and remove the water marks.
- 7.17. In Rooms CA1 (approximately 9 linear feet), above the ceiling of SJ1 (approximately 4 linear feet), 11th Floor Outer Ring (approximately 11 linear feet), 10TS3 (approximately 3 linear feet), 9TS3 (approximately 3 linear feet), 4TS3 (approximately 5 linear feet), and 3TS5 (approximately 10 linear feet), the water stained pipe insulation shall be removed and replaced.
- 7.18. Between Room 2TS5 and the corridor, approximately 1 linear foot of uninsulated chilled water return piping passing between two metal studs adjacent to the door, shall be insulated. Trim flange of metal stud to install insulation and brace cut studs to adjacent uncut studs with a section of metal stud or runner.
- 7.19. Place MCM and MCE in a fiber/cardboard type drum or 2-layers of 6-mil polyethylene disposal bags with contents clearly labeled. At completion of each phase, notify the Government of completion so that Government can perform a visual inspection of the work area. Allow negative pressure system to operate a minimum of two hours after the last clean-up effort.
- 7.20. Upon approval of Government, remove barriers and disassemble regulated work area. Additional cleaning required in the work area because of the Government

inspection, shall be performed by Contractor, at no additional cost to the Government.

- 8.0 AIR MONITORING AND INSPECTION.** The Government retained industrial hygienist will determine any requirement for air monitoring, both during the remediation process and/or upon completion of the remediation process. Such area sampling will be conducted using Zefon filters and a high volume sampling pump. Procedural modifications to the decontamination procedures may be necessary at the discretion of the Government-retained industrial hygienist. The Government has the right to inspect the remediation work at times to be determined by the Government, but, at a minimum, once upon completed removal of contaminated materials, but before new drywall is installed.
- 9.0 FINAL CLEARANCE.** Acceptance of work will be dependant upon visual inspection and/or clearance monitoring. The Contractor shall notify the Government when the microbiological removal is completed for each phase and the Government-retained industrial hygienist shall perform a thorough visual inspection of the phase within 24-hours. After Rooms SJ1, 11TS5, 10TS5, and 3TS5 have passed the visual inspection, clearance air sampling shall be performed. Clearance criteria shall be dependant upon the requirements stipulated in the MCI ATCT Mold Remediation Clearance Protocol. All remaining rooms shall be cleared by visual inspection.
- 10.0 DISPOSAL.** All microbiological waste shall be disposed of at a municipal sanitary landfill. Waste bags shall not be overloaded and shall be securely sealed and stored in the designated area until disposal. Label bags, disposal containers, and truck during loading and unloading, in accordance with Federal, State and Local regulations. Contractor is responsible for removal of all materials from the Government's property.

ATTACHMENT 1

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



New York City Department of Health & Mental
Hygiene
Bureau of Environmental & Occupational Disease

Epidemiology

Guidelines on Assessment and Remediation of Fungi in Indoor Environments

- Executive Summary
- Introduction
- Health Issues
- Environmental Assessment
- Remediation
- Hazard Communication
- Conclusion
- Notes and References
- Acknowledgments

Executive Summary

On May 7, 1993, the New York City Department of Health (DOH), the New York City Human Resources Administration (HRA), and the Mt. Sinai Occupational Health Clinic convened an expert panel on *Stachybotrys atra* in Indoor Environments. The purpose of the panel was to develop policies for medical and environmental evaluation and intervention to address *Stachybotrys atra* (now known as *Stachybotrys chartarum* (SC)) contamination. The original guidelines were developed because of mold growth problems in several New York City buildings in the early 1990's. This document revises and expands the original guidelines to include all fungi

(mold). It is based both on a review of the literature regarding fungi and on comments obtained by a review panel consisting of experts in the fields of microbiology and health sciences. It is intended for use by building engineers and management, but is available for general distribution to anyone concerned about fungal contamination, such as environmental consultants, health professionals, or the general public.

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

- Many fungi (e.g., species of *Aspergillus*, *Penicillium*, *Fusarium*, *Trichoderma*, and *Memnoniella*) in addition to SC can produce potent mycotoxins, some of which are identical to compounds produced by SC. Mycotoxins are fungal metabolites that have been identified as toxic agents. For this reason, SC cannot be treated as uniquely toxic in indoor environments.
- People performing renovations/cleaning of widespread fungal contamination may be at risk for developing Organic Dust Toxic Syndrome (ODTS) or Hypersensitivity Pneumonitis (HP). ODTS may occur after a *single heavy* exposure to dust contaminated with fungi and produces flu-like symptoms. It differs from HP in that it is not an immune-mediated disease and does not require repeated exposures to the same causative agent. A variety of biological agents may cause ODTS including common species of fungi. HP may occur after repeated exposures to an allergen and can result in permanent lung damage.
- Fungi can cause allergic reactions. The most common symptoms are runny nose, eye irritation, cough, congestion, and aggravation of asthma.

Fungi are present almost everywhere in indoor and outdoor environments. The most common symptoms of fungal exposure are runny nose, eye irritation, cough, congestion, and aggravation of asthma. Although there is evidence documenting severe health

effects of fungi in humans, most of this evidence is derived from ingestion of contaminated foods (i.e., grain and peanut products) or occupational exposures in agricultural settings where inhalation exposures were very high. With the possible exception of remediation to very heavily contaminated indoor environments, such high-level exposures are not expected to occur while performing remedial work.

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

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

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

The use of respiratory protection, gloves, and eye protection is recommended. Extensive contamination, particularly if heating, ventilating, air conditioning (HVAC) systems or large occupied spaces are involved, should be assessed by an experienced health and safety professional and remediated by personnel with training and experience handling environmentally contaminated materials. Lesser areas of contamination can usually be assessed and remediated by building maintenance personnel. In order to prevent contamination from recurring, underlying defects causing moisture buildup and water damage must be addressed. Effective communication with building occupants is an essential component of all remedial efforts.

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

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

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

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Introduction

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

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

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

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

- Many fungi (e.g., species of *Aspergillus*, *Penicillium*, *Fusarium*, *Trichoderma*, and *Memnoniella*) in addition to SC can produce potent mycotoxins, some of which are identical to compounds produced by SC.^{1, 2, 3, 4} Mycotoxins are fungal metabolites that

have been identified as toxic agents. For this reason, SC cannot be treated as uniquely toxic in indoor environments.

- People performing renovations/cleaning of widespread fungal contamination may be at risk for developing Organic Dust Toxic Syndrome (ODTS) or Hypersensitivity Pneumonitis (HP). ODTS may occur after a *single heavy* exposure to dust contaminated with fungi and produces flu-like symptoms. It differs from HP in that it is not an immune-mediated disease and does not require repeated exposures to the same causative agent. A variety of biological agents may cause ODTS including common species of fungi. HP may occur after repeated exposures to an allergen and can result in permanent lung damage.^{5, 6, 7, 8, 9, 10}
- Fungi can cause allergic reactions. The most common symptoms are runny nose, eye irritation, cough, congestion, and aggravation of asthma.^{11, 12}

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

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

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

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

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

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1. Health Issues

1.1 Health Effects

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

There are only a limited number of documented cases of health problems from indoor exposure to fungi. The intensity of

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

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

1.1.1 Immunological Effects

Immunological reactions include asthma, HP, and allergic rhinitis. Contact with fungi may also lead to dermatitis. It is thought that these conditions are caused by an immune response to fungal agents. The most common symptoms associated with allergic reactions are runny nose, eye irritation, cough, congestion, and aggravation of asthma.^{11, 12} HP may occur after repeated exposures to an allergen and can result in permanent lung damage. HP has typically been associated with repeated

heavy exposures in agricultural settings but has also been reported in office settings.^{25, 26, 27} Exposure to fungi through renovation work may also lead to initiation or exacerbation of allergic or respiratory symptoms.

1.1.2 Toxic Effects

A wide variety of symptoms have been attributed to the toxic effects of fungi. Symptoms, such as fatigue, nausea, and headaches, and respiratory and eye irritation have been reported. Some of the symptoms related to fungal exposure are non-specific, such as discomfort, inability to concentrate, and fatigue.^{11, 12, 16-20} Severe illnesses such as ODS and pulmonary hemosiderosis have also been attributed to fungal exposures.^{5-10, 21, 22}

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

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

1.1.3 Infectious Disease

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

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

1.2 Medical Evaluation

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

Clinical tests that can determine the source, place, or time of exposure to fungi or their products are not currently available. Antibodies developed by exposed persons to fungal agents can

only document that exposure has occurred. Since exposure to fungi routinely occurs in both outdoor and indoor environments this information is of limited value.

1.3 Medical Relocation

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

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

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2. Environmental Assessment

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

2.1 Visual Inspection

A visual inspection is the most important initial step in identifying a possible contamination problem. The extent of any

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

2.2 Bulk/Surface Sampling

- a. Bulk or surface sampling is not required to undertake a remediation. Remediation (as described in Section 3, Remediation) of visually identified fungal contamination should proceed without further evaluation.
- b. Bulk or surface samples may need to be collected to identify specific fungal contaminants as part of a medical evaluation if occupants are experiencing symptoms which may be related to fungal exposure or to identify the presence or absence of mold if a visual inspection is equivocal (e.g., discoloration, and staining).
- c. An individual trained in appropriate sampling methodology should perform bulk or surface sampling. Bulk samples are usually collected from visibly moldy surfaces by scraping or cutting materials with a clean tool into a clean plastic bag. Surface samples are usually collected by wiping a measured area with a sterile swab or by stripping the suspect surface with clear tape. Surface sampling is less destructive than bulk sampling. Other sampling methods may also be available. A laboratory specializing in mycology should be consulted for specific sampling and delivery instructions.

2.3 Air Monitoring

- a. Air sampling for fungi should not be part of a routine assessment. This is because decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some fungi are prone to false negative results and therefore cannot be used to definitively rule out contamination.
- b. Air monitoring may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with a fungal exposure (e.g., pulmonary hemorrhage/hemosiderosis, and aspergillosis).
- c. Air monitoring may be necessary if there is evidence from a visual inspection or bulk sampling that ventilation systems may be contaminated. The purpose of such air monitoring is to assess the extent of contamination throughout a building. It is preferable to conduct sampling while ventilation systems are operating.
- d. Air monitoring may be necessary if the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling (e.g., mold growth behind walls). The purpose of such air monitoring is to determine the location and/or extent of contamination.
- e. If air monitoring is performed, for comparative purposes, outdoor air samples should be collected concurrently at an air intake, if possible, and at a location representative of outdoor air. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
- f. Personnel conducting the sampling must be trained in proper air sampling methods for microbial contaminants. A laboratory specializing in mycology should be consulted

for specific sampling and shipping instructions.

2.4 Analysis of Environmental Samples

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

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

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3. Remediation

In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur. Any initial water infiltration should be stopped and cleaned immediately. An

immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity should be maintained at levels below 60% to inhibit mold growth.³¹ Emphasis should be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.

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

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

work.

The use of gaseous, 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. For additional information on the use of biocides for remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."

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

- a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
- b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.
- c. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking)

surfaces prior to remediation, are recommended.

- e. Contaminated materials that cannot be cleaned should be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.
- f. The work area and areas used by remedial workers for egress should be cleaned with a damp cloth and/or mop and a detergent solution.
- g. All areas should be left dry and visibly free from contamination and debris.

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

- a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
- b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.
- c. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- d. The work area should be covered with a plastic sheet(s) and

- sealed with tape before remediation, to contain dust/debris.
- e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - f. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - g. The work area and areas used by remedial workers for egress should be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.
 - h. All areas should be left dry and visibly free from contamination and debris.

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

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

The following procedures *at a minimum* are recommended:

- a. Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.
- b. The work area and areas directly adjacent should be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.
- c. Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.

- d. The work area and areas directly adjacent should be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- f. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
- g. The work area and surrounding areas should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
- h. All areas should be left dry and visibly free from contamination and debris.

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

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

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

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

- i. Full-face respirators with high efficiency particulate air (HEPA) cartridges
 - ii. Disposable protective clothing covering both head and shoes
 - iii. Gloves
- b. Containment of the affected area:
 - i. Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
 - ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization
 - iii. Airlocks and decontamination room
- c. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- d. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
- e. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.
- f. Air monitoring should be conducted prior to occupancy to

determine if the area is fit to reoccupy.

3.5 Level V: Remediation of HVAC Systems

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

- a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
- b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.
- c. The HVAC system should be shut down prior to any remedial activities.
- d. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
- e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- f. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
- g. The work area and areas immediately surrounding the work area should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.

- h. All areas should be left dry and visibly free from contamination and debris.
- i. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

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

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

- a. Personnel trained in the handling of hazardous materials equipped with:
 - i. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
 - ii. Gloves and eye protection
 - iii. Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes should be worn if contamination is greater than 30 square feet.
- b. The HVAC system should be shut down prior to any remedial activities.
- c. Containment of the affected area:
 - i. Complete isolation of work area from the other areas

- of the HVAC system using plastic sheeting sealed with duct tape.
- ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization.
 - iii. Airlocks and decontamination room if contamination is greater than 30 square feet.
- d. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
- e. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.
- f. All areas should be left dry and visibly free from contamination and debris.
- g. Air monitoring should be conducted prior to re-occupancy with the HVAC system in operation to determine if the area (s) served by the system are fit to reoccupy.
- h. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

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4. Hazard Communication

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

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Conclusion

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

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

types of exposures.

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