



**OFFICE OF
ENVIRONMENTAL HEALTH
AND SAFETY**

**FACILITIES
AND
SERVICES**

PROCEDURES FOR REMEDIATION OF FUNGI
IN INDOOR ENVIRONMENTS

LEVEL I:

SMALL ISOLATED AREA (less than 10sq. ft.)
-- e.g. CEILING TILES AND SMALL AREAS ON WALLS

PROCEDURES FOR REMEDIATION OF FUNGI

IN INDOOR ENVIRONMENTS (Level I)

When authorized workers conduct activities involving the remediation of fungi in an indoor area, specific precautions are required in order to maintain a safe work environment for workers and other building occupants.

The procedures are based on methods of the New York City Department of Health and Mental Hygiene's *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (2008), WorkSafe Manitoba's *Guide for the Investigation, Assessment, & Remediation of Mould in Workplaces* (2015) and the Environmental Abatement Council of Ontario (EACO)'s *Mould Abatement Guidelines* (2015).

1.0 APPLICATION

These procedures apply to all work involving the remediation of fungi in a small isolated area (less than 10 sq. ft. of contaminated surface) -- e.g. a few ceiling tiles or small areas on walls in an indoor environment. The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and contaminated dust from leaving the work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.

2.0 HAZARD COMMUNICATION

It is imperative that all building-users are aware of the planned activities concerning remediation of fungi. As appropriate, the following methods should be used to communicate this message:

.1 Memorandum to Building Occupants

This memorandum informs the building occupants of the planned work and in general terms includes the precautionary measures required to maintain a safe work environment for all the building occupants. The memorandum should also include that vacating people from spaces adjacent to the work area is not necessary but is recommended to persons having undergone recent surgery, immune suppressed people and people with chronic inflammatory lung diseases (e.g. asthma, hypersensitivity pneumonitis, and severe allergies).

.2 Signage in the Building Lobby/Entrance

The signs will inform/remind all building users that the planned work is in progress and will continue for the specified period.

.3 Signage at the Work Location

These signs inform building users that entry into the isolated work area is restricted to authorized personnel only.

3.0 DEFINITIONS

- .1 *HEPA Vacuum:* Vacuum cleaner equipped with High Efficiency Particulate Air Filter, fitted with appropriate tools. The vacuum equipment shall have a filtering system capable of collecting and retaining particles greater than 0.3 microns in diameter at 99.97% efficiency.
- .2 *Damp-Wiping:* A cleaning process for removing residual fungal contamination using damp-cloths, sponges or mops.
- .3 *Misting:* A dust suppression method intended to minimize the spread of mould or spores. Misting occurs prior to removal of contaminated material.
- .4 *Polyethylene Sheeting:* Polyethylene sheeting 6 mil. thick, in largest sheet size available to minimize seams.
- .5 *Work Areas:* Where actual work activity involving fungal remediation takes place.
- .6 *DOP Test:* Dioctylphthalate aerosol challenge of a HEPA filter system and is used to establish the integrity and effectiveness of the system to filter out particles in the respirable range.

4.0 PERSONAL PROTECTION

- .1 *Respirators* All Respiratory equipment shall be individually assigned and identified. Each worker must be instructed and tested with his respirator. During all work that may generate airborne fungal contamination (i.e. including preparatory work, if it is likely that the fungi could be disturbed), workers shall wear **half or full-facepiece respirators with high efficiency particulate air (HEPA) filter cartridges.** Disposable single-use type respirators are **not** permitted. Replace filter cartridges as appropriate. All respirators shall be approved and labelled for protection against particulates and shall meet the design and usage requirements of the National Institute for Occupational Safety and Health (NIOSH). No supervisor or worker shall have **facial hair**, which affects respirator-to-face seal.
- .2 *Protective Equipment:* All workers must be provided with appropriate gloves and eye protection.
- .3 *Facilities:* Provide facilities for washing hands and face, which shall be used by every worker when leaving fungal-contaminated work areas.
- .4 *Practice:* Workers shall not eat, drink, smoke or chew while in contaminated work areas.
- .5 *Work Area Entry:* All persons shall don respirators with HEPA filters and appropriate gloves and eye protection before entering work

area.

- .6 Work Area *Exit*: Before leaving the work area and still wearing a respirator, a worker shall:
- Thoroughly HEPA vacuum all exposed skin, protective clothing, respirator, and shoes.

Leave the work area in street clothes and proceed to the nearest washroom to wash hands and face.

Thoroughly wash out respirator between uses.

5.0 **TRAINING**

Remediation shall be conducted by only those personnel who have received training in:

- .1 The potential health hazards of fungi exposure and other aspects related to the remediation of fungi in indoor environments.
- .2 The proper use of personal protection, including respiratory protection and protective clothing.
- .3 Proper clean-up methods associated with the remediation of fungi in indoor environments.

6.0 **PREPARATION: Work Areas**

The work area shall be unoccupied (i.e. building occupants/users shall not work in or enter an area where work activity involving fungal remediation takes place).

Before beginning work:

- .1 HEPA vacuum all objects that will be removed from the work area.
- .2 Remove all moveable objects from the work area prior to commencement of the remedial work.
- .3 Mist (not soak) all mould contaminated materials to minimize the spread of mould spores.
- .4 Enclosure of the work area with polyethylene sheeting is not necessary, however where practicable, cover the floor below the mouldy material with polyethylene drop-sheets to catch debris.
- .5 Post signs warning of the fungal hazard at entrances to the work area.
- .6 Don respiratory equipment and protective equipment as described in 4.1 and 4.2.
- .7 Ensure other hazards in the area (e.g. asbestos, electrical safety) are

7.0 FUNGAL REMEDIATION AND DISPOSAL

- .1 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 contaminated can be cleaned and reused. Cleaning shall be done using a HEPA vacuum, followed by cleaning of the surfaces with a detergent solution. The University may require more stringent cleaning requirements depending on the specific environmental conditions and affected materials involved in the mould abatement. These requirements (e.g. the use of warrior/isocare commercial microbial remediation systems etc.) will be specified by the Office of Environmental Health and Safety prior to the remediation. Porous materials, such as ceiling tiles and insulation, and wallboards with more than a small area of contamination shall be removed and discarded; dust suppression methods, such as misting (not soaking) these porous materials, prior to removal and disposal shall be used. Porous materials (e.g. wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded, if possible.
- .2 Remove any porous substrate materials (ceiling tiles, drywall, etc.) to a point beyond the immediate areas of visible contamination, for a minimum distance of 30 cm in all directions.
- .3 All materials to be reused must be dry and visibly free from fungal contamination.
- .4 Contaminated materials that cannot be cleaned shall be double-bagged in 6 mil. polyethylene bags, and securely tied immediately within the work area.
- .5 The outside of the bags shall be cleaned with a damp cloth and a cleaning/detergent solution or HEPA vacuumed in the work area prior to their transport to external clean areas. **There are no special requirements for the disposal of fungal-contaminated materials.**
- .6 The work area shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a cleaning/detergent solution, and be visibly clean prior to the removal of the polyethylene drop-sheets, if any. Polyethylene sheeting that will not be reused must be double bagged and disposed of as contaminated waste.



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PROCEDURES FOR REMEDIATION OF FUNGI
IN INDOOR ENVIRONMENTS

LEVEL II:

MID-SIZED ISOLATED AREA (10 – 30 sq. ft.)
-- e.g. SEVERAL CEILING TILES OR INDIVIDUAL WALLBOARD PANELS

PROCEDURES FOR REMEDIATION OF FUNGI

IN INDOOR ENVIRONMENTS (Level II)

When authorized workers conduct activities involving the remediation of fungi in an indoor area, specific precautions are required in order to maintain a safe work environment for workers and other building occupants.

The procedures are based on methods of the New York City Department of Health and Mental Hygiene's *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (2008), WorkSafe Manitoba's *Guide for the Investigation, Assessment, & Remediation of Mould in Workplaces* (2015) and the Environmental Abatement Council of Ontario (EACO)'s *Mould Abatement Guidelines* (2015).

1.0 APPLICATION

These procedures apply to all work involving the remediation of fungi in a mid-large sized isolated area (10 - 30 sq. ft. of contaminated surface) -- e.g. several ceiling tiles or individual wallboard panels in an indoor environment. The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and contaminated dust from leaving the work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.

2.0 HAZARD COMMUNICATION

It is imperative that all building-users are aware of the planned activities concerning remediation of fungi. The following methods should be used to communicate this message:

.1 Memorandum to Building Occupants

This memorandum informs the building occupants of the planned work and in general terms includes the precautionary measures required to maintain a safe work environment for all the building occupants. The memorandum should also include that vacating people from spaces adjacent to the work area is not necessary but is recommended to persons having undergone recent surgery, immune suppressed people and people with chronic inflammatory lung diseases (e.g. asthma, hypersensitivity pneumonitis, and severe allergies).

.2 Signage in the Building Lobby/Entrance

The signs will inform/remind all building users that the planned work is in progress and will continue for the specified period.

.3 Signage at the Work Location

These signs inform building users that entry into the isolated work area is restricted to authorized personnel only.

3.0 DEFINITIONS

- .1 **HEPA Vacuum:** Vacuum cleaner equipped with High Efficiency Particulate Air Filter, fitted with appropriate tools. The vacuum equipment shall have a filtering system capable of collecting and retaining particles greater than 0.3 microns in diameter at 99.97% efficiency.

- .2 *Damp-Wiping:* A cleaning process for removing residual fungal contamination using damp-cloths, sponges or mops.
- .3 *Misting:* A dust suppression method intended to minimize the spread of mould or spores. Done prior to removal of contaminated material.
- .4 *Polyethylene Sheeting:* 6 mil. thickness, in largest sheet size available to minimize seams.
- .5 *Rip-Proof Polyethylene:* 12 mil. thickness, fibre reinforced and in sheet size to minimize seams.
- .6 *Enclosure:* An impermeable barrier made of polyethylene plastic or similar material, behind which fungal remediation will take place.
- .7 *Polyethylene sheeting sealed with tape:* Polyethylene sheeting of thickness specified, sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to prevent escape of fungal particles through the sheeting into a clean area.
- .8 *Work Areas:* Where actual work activity involving fungal remediation takes place.
- .9 *DOP Test:* Dioctylphthalate aerosol challenge of a HEPA filter system and is used to establish the integrity and effectiveness of the system to filter out particles in the respirable range.

4.0 PERSONAL PROTECTION

- .1 *Respirators* All Respiratory equipment shall be individually assigned and identified. Each worker must be instructed and tested with his respirator. During all work that may generate airborne fungal contamination (i.e. including preparatory work, if it is likely that the fungi could be disturbed), workers shall wear **half or full-facepiece respirators with high efficiency particulate air (HEPA) filter cartridges.** Disposable single-use type respirators are **not** permitted. Replace filter cartridges as appropriate. All respirators shall be approved and labelled for protection against particulates and shall meet the design and usage requirements of the National Institute for Occupational Safety and Health (NIOSH). No supervisor or worker shall have **facial hair**, which affects respirator-to-face seal.
- .2 *Protective Clothing:* All workers must be provided with full body disposable coveralls, extra large size with attached hood and elasticized at cuffs and hood, made of material which does not readily retain nor permit penetration of fungal particles. Shoe covers are also required. Appropriate gloves and eye protection must be worn.
- .3 *Facilities:* Provide facilities for washing hands and face, which shall be

used by every worker when leaving fungal-contaminated work areas.

- .4 *Practice:* Workers shall not eat, drink, smoke or chew while in contaminated work areas.
- .5 *Enclosure Entry:* All persons shall don respirators with HEPA filters, clean coveralls and appropriate gloves and eye protection before entering work area enclosure.
- .6 *Enclosure Exit:* Before leaving the enclosure and still wearing a respirator, a worker shall:
 - Thoroughly HEPA vacuum all exposed skin, protective clothing, respirator, shoes and hair (after removing hood).
 - Remove decontaminated coveralls and wash hands and face with water (in enclosure).
 - Leave the enclosure in street clothes and proceed to the nearest washroom to wash hands and face.
 - Coveralls may be reused throughout a day provided they are disposed of after each shift.
 - Thoroughly wash out respirator between uses.

5.0 TRAINING

Remediation shall be conducted by only those personnel who have received training in:

- .1 The potential health hazards of fungi exposure and other aspects related to the remediation of fungi in indoor environments.
- .2 The proper use of personal protection, including respiratory protection and protective clothing.
- .3 Proper clean-up methods associated with the remediation of fungi in indoor environments.

6.0 PREPARATION: Work Areas

The work area shall be unoccupied (i.e. building occupants/users shall not work in or enter an area where work activity involving fungal remediation takes place).

Before beginning work:

- .1 HEPA vacuum all objects that will be removed from the work area. Remove all waste as fungal-contaminated material.
- .2 Remove all moveable objects from the work area prior to commencement of work by the abatement contractor.
- .3 Pre-clean all work areas using a HEPA vacuum cleaner or wet cleaning method, where practical. Do not use methods that raise dust, such as dry sweeping, or

vacuuming using other than HEPA vacuum equipment. This work shall include the cleaning of all horizontal surfaces, floors, surfaces of immovable objects and any other surfaces where fungal particulate or dust could possibly occur. This work shall be carried out before placing the polyethylene on walls, floors, ducts or machinery.

- .4 Equipment or objects that cannot be removed shall be sealed with 6 mil polyethylene sheeting, sealed with tape suitable for use in wet and dry conditions.
- .5 Provide a temporary enclosure to prevent the spread of airborne dust from the work area. Use a prefabricated enclosure or erect an enclosure constructed of two layers of 6 mil. polyethylene plastic sheeting such that the proposed work is entirely within the enclosure; either erect temporary framing to support polyethylene, or clip and tape polyethylene to ceiling system and the floor. Where appropriate, use rip-proof polyethylene sheeting (12 mil.) for the floor of the enclosure. The enclosure shall be as airtight as conditions permit including the provision of a double overlapping flap at the entrance.
- .6 The enclosure must be kept at negative pressure at all times during the operation, with minimum pressure differential of at least -5Pa relative to the air outside of the enclosure. Locate HEPA vacuum body outside enclosure. Locate vacuum hose within enclosure to provide the negative pressure in enclosure.
Note: All HEPA vacuum cleaners that will operate outside of the containment area must be DOP tested immediately prior to initial usage.
- .7 Isolate or "turn off" the ventilation **to** and **from** the work area to prevent contamination and fungal dispersal to other areas of the building during work phase. The utmost care shall be taken to ensure that when this is done these actions will not affect the heating and ventilation systems supplying adjacent occupied areas.
- .8 All openings within the work area shall be double sealed with two layers of 6 mil. polyethylene sheet. Such openings shall in general encompass, but not be restricted to ducts, vents, grilles, floor drains, skylights, windows, doors, electrical ducts and boxes.
- .9 Mist (not soak) all mould contaminated materials to minimize the spread of mould spores.
- .10 Post signs warning of the fungal hazard at entrances to the work area(s).
- .11 Don respiratory equipment and coveralls as described in 4.1 and 4.2.

7.0 FUNGAL REMEDIATION AND DISPOSAL

- .1 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 contaminated can be cleaned and reused. Cleaning shall be done using a HEPA vacuum, followed by cleaning of the surfaces with a detergent solution. The University may require more stringent cleaning requirements depending on the specific environmental conditions and affected materials involved in the mould abatement. These requirements (e.g. the use of warrior/isocare commercial microbial remediation systems etc.) will be specified by the Office of Environmental Health and Safety prior to the remediation. Porous materials that cannot be adequately cleaned, such as ceiling tiles and insulation, and wallboards with more than a small area of contamination shall be removed and discarded; dust suppression methods, such as misting (not soaking)

these porous materials, prior to removal and disposal shall be used. Porous materials (e.g. wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded, if possible.

- .2 Remove any porous substrate materials (ceiling tiles, drywall, etc.) to a point beyond the immediate areas of visible contamination, for a minimum distance of 30 cm in all directions.
- .3 All materials to be reused must be dry and visibly free from fungal contamination.
- .4 All materials that cannot be cleaned shall be double-bagged in 6 mil. polyethylene bags, and securely tied immediately within the work area.
- .5 The outside of the bags shall be cleaned with a damp cloth and a cleaning/detergent solution or HEPA vacuumed in the enclosure prior to their transport to external clean areas. **There are no special requirements for the disposal of fungal-contaminated materials.**
- .6 The work area shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a cleaning/detergent solution, and be visibly clean prior to the removal of the polyethylene plastic enclosures. Polyethylene plastic that will not be reused must be double bagged and disposed of as contaminated waste.



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PROCEDURES FOR REMEDIATION OF FUNGI

IN INDOOR ENVIRONMENTS

LEVEL III:

**VERY LARGE ISOLATED AREA
(greater than 30 contiguous sq. ft.)
OR AREA WITH EXTENSIVE CONTAMINATION**

PROCEDURES FOR REMEDIATION OF FUNGI

IN INDOOR ENVIRONMENTS (Level III)

When authorized workers conduct activities involving the remediation of fungi in an indoor area, specific precautions are required in order to maintain a safe work environment for workers and other building occupants.

The procedures are based on methods of the New York City Department of Health and Mental Hygiene's *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (2008), WorkSafe Manitoba's *Guide for the Investigation, Assessment, & Remediation of Mould in Workplaces* (2015) and the Environmental Abatement Council of Ontario (EACO)'s *Mould Abatement Guidelines* (2015).

1.0 APPLICATION

These procedures apply to all work involving the remediation of fungi in a very large isolated area (greater than 30 contiguous square feet of contaminated surface) or an area with extensive contamination in an indoor environment. The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and contaminated dust from leaving the work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.

2.0 HAZARD COMMUNICATION

It is imperative that all building-users are aware of the planned activities concerning remediation of fungi. The following methods should be used to communicate this message:

.1 *Memorandum to Building Occupants*

This memorandum informs the building occupants of the planned work and in general terms includes the precautionary measures required to maintain a safe work environment for all the building occupants. The memorandum should also include that vacating people from spaces adjacent to the work area is not necessary but is recommended to persons having undergone recent surgery, immune suppressed people and people with chronic inflammatory lung diseases (e.g. asthma, hypersensitivity pneumonitis, and severe allergies).

.2 *Signage in the Building Lobby/Entrance*

The signs will inform/remind all building users that the planned work is in progress and will continue for the specified period.

.3 *Signage at the Work Location*

These signs inform building users that entry into the isolated work area is restricted to authorized personnel only.

3.0 FACILITIES AND SERVICES CONTACTS

Project Co-ordinator - Name ? (Phone #)

The project co-ordinator is responsible for overseeing the entire project and ensuring that all parties are aware and perform their respective duties according to the written instructions as

detailed in these procedures and the written specifications from Facilities and Services.

The co-ordinator is responsible for approving all submittals (see section 5), and as appropriate, may do this in conjunction with the Office of Environmental Health & Safety.

The co-ordinator will receive and review the consultant's report (see section 4) within 24 hours of (the consultant) completing the inspections for that day.

At the discretion of the co-ordinator, when a significant aberration in remedial work occurs, he/she will promptly submit a report to the Office of Environmental Health and Safety. As appropriate, the co-ordinator will also submit reports to the pertinent Department Chair(s) and the Co-chairs of pertinent Joint Health & Safety Committees.

Ventilation System Co-ordinator - Name ? (Phone #)

This co-ordinator has sole authority to "shut down" and "turn on" the various building ventilation systems, as required.

- .1 The Ventilation System Co-ordinator must certify that ventilation to and from the work area has been "shut down" before the abatement contractor begins any preparatory work.
- .2 The Ventilation System Co-ordinator must be notified by the abatement contractor that all work has been completed before ventilation "to" and "from" the work area can be "turned on".

4.0 WORK INSPECTIONS

The abatement contractor's work will be subject to critical scrutiny by the Facilities and Services Project Co-ordinator and the mould consulting firm of (-- Name --). This consists of random/continuous inspections, which will include assessing enclosure containment and the actual work practices used by the contractor (see Appendix A).

The inspections of work areas during contamination periods will be performed to ensure compliance with the specification and governing authorities' requirements. Any variances from specification and governing authorities' requirements that have not been approved in writing may result in the consultant shutting down the removal operations in the work area at no cost to the owner until compliance is assured.

In the event that the inspections of the work area are found unacceptable by the consultant's standards, the standards specified or required by governing authorities, all re-inspection required to obtain consent to proceed from the consultant will be performed with no cost to the owner. All costs for re-inspection shall be borne by the abatement contractor.

The consulting firm will issue a report to the Facilities and Services Project Co-ordinator within 24 hours of completing the inspections for that day. At the discretion of the co-ordinator, when a significant aberration in remedial work occurs, he/she will promptly submit a report to the Office of Environmental Health and Safety. As appropriate, the co-ordinator will also submit reports to the pertinent Department Chair(s) and the Co-chairs of pertinent Joint Health & Safety Committees.

5.0 SUBMITTALS

Before commencing work on each phase, the abatement contractor shall:

- .1 Submit proof satisfactory to the Project Co-ordinator that all employees have had proper instruction on the hazards of fungi exposure, respirator use, protective clothing, entry and exit from work areas, and all aspects of work procedures and protective measures.
- .2 Submit for review and approval, drawings showing layout of proposed enclosures including decontamination facilities and proposed location of negative pressure unit or units, as well as the discharge directly to the outdoors.
- .3 Submit performance data on all HEPA vacuum cleaners to be used at the worksite(s); include DOP test data that is no more than two (2) months old. All HEPA vacuum cleaners that will be operated outside of the containment area must be DOP tested immediately prior to initial usage.
- .4 Submit performance data on all negative air units; include DOP test data. All units must be DOP tested on site, immediately prior to initial usage, when HEPA filters are changed and after unit has been transported to a new location.
- .5 At the discretion of the Project Co-ordinator, submit documentation, including test results and manufacturer's data sheets (where applicable) for:
 - 1) Detergent solutions
 - 2) Tape
 - 3) Rip-proof polyethylene
- .6 Submit for consideration, all variances from specification and governing authorities' requirement. **Note:** variances will only be considered under exceptional circumstances.

6.0 DEFINITIONS

- .1 *HEPA Vacuum:* Vacuum cleaner equipped with High Efficiency Particulate Air Filter, fitted with appropriate tools. The vacuum equipment shall have a filtering system capable of collecting and retaining particles greater than 0.3 microns in diameter at 99.97% efficiency.
- .2 *Damp-Wiping:* A cleaning process for removing residual fungal contamination using damp-cloths, sponges or mops.
- .3 *Misting:* A dust suppression method intended to minimize the spread of mould or spores. Done prior to removal of contaminated material.
- .4 *Polyethylene Sheeting:* 6 mil. thickness, in largest sheet size available to minimize seams.
- .5 *Rip-Proof Polyethylene:* 12 mil. thickness, fibre reinforced and in sheet size to minimize seams.

- .6 *Enclosure:* An impermeable barrier made of polyethylene plastic or similar material, behind which fungal remediation will take place.
- .7 *Polyethylene sheeting sealed with tape:* Polyethylene sheeting of thickness specified, sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to prevent escape of fungal particles through the sheeting into a clean area.
- .8 *Work Areas:* Where actual work activity involving fungal remediation takes place.
- .9 *Negative Pressure system:* One which extracts air directly from work area, filters such extracted air through a High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building. This system shall maintain a minimum pressure differential of 5 Pa (0.02 inches of water column) relative to adjacent areas outside of work areas, be equipped with an alarm to warn of system breakdown, and should be equipped with an instrument to continuously monitor and automatically record (hard copy) pressure differences.
- .10 *Curtained doorway:* An arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed by placing two overlapping sheets of polyethylene over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. All free edges of polyethylene shall be reinforced with duct tape and the bottom edge shall be weighted to ensure proper closing. Each polyethylene sheet shall overlap openings not less than 1.5 m (5ft) on each side.
- .11 *Airlock:* A system for permitting ingress or egress without permitting air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways at least 2 m (6.5ft) apart.
- .12 *DOP Test:* Dioctylphthalate aerosol challenge of a HEPA filter system and is used to establish the integrity and effectiveness of the system to filter out particles in the respirable range.

7.0 **PERSONAL PROTECTION**

- .1 *Respirators* All Respiratory equipment shall be individually assigned and identified. Each worker must be instructed and tested with his respirator. During all work that may generate airborne fungal contamination (i.e. including preparatory work, if it is likely that the fungi could be disturbed), workers shall wear **half or full-facepiece respirators with high efficiency**

particulate air (HEPA) filter cartridges. Disposable single-use type respirators are **not** permitted. Replace filter cartridges as appropriate. All respirators shall be approved and labelled for protection against particulates and shall meet the design and usage requirements of the National Institute for Occupational Safety and Health (NIOSH). No supervisor or worker shall have **facial hair**, which affects respirator-to-face seal.

.2 *Protective Clothing:*

All workers must be provided with full body disposable coveralls, extra large size with attached hood and elasticized at cuffs and hood, made of material which does not readily retain nor permit penetration of fungal particles. Shoe covers are also required. Alternately, reusable protective clothing may be used if it is left in the Decontamination Room until the end of the abatement work, at which time such items shall be disposed of as fungal-contaminated waste. Appropriate gloves and eye protection must be worn.

.3 *Each worker shall:*

.1

Remove street clothes in the Clean Room and put on respirator with new filters or reusable filters, clean coveralls, head covers and shoe covers before entering Decontamination Room or work area. If reusable protective clothing is used each worker shall don respiratory protection only before entering the Decontamination Room where clothing is stored. All street clothes, uncontaminated footwear, towels, and similar uncontaminated articles shall be stored in the Clean Room.

.2

Remove gross contamination from clothing before leaving work area then proceed to Decontamination Room and remove all clothing except respirators. Place contaminated coveralls and shoe covers that will not be reused in receptacles for disposal with other fungal-contaminated materials. Reusable protective clothing and work footwear must be HEPA vacuumed and/or damp-wiped prior to removal. Leave reusable items except respirator in the Decontamination Room. Clean the outside of the respirator; remove respirator, remove filters and store those that will be reused; dispose of those that will be discarded in the waste receptacle; wash and rinse the inside of the respirator. Upon completion of the remedial operations, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from the Decontamination Room.

.3

Following personal decontamination, proceed to Clean Room and dress in street clothes before exiting the Clean Room into the external clean area outside the enclosure system. If re-entering work area, follow procedures outlined in 7.3.1 above.

.4

Be fully protected with the appropriate respirator (see 7.1) and protective clothing (see 7.2) during preparation of the

system of enclosures prior to commencing actual fungal remediation.

8.0 TRAINING

Remediation shall be conducted by only those workers who have received training in:

- .1 The potential health hazards of fungi exposure and other aspects related to the remediation of fungi in indoor environments.
- .2 The proper use of personal protection, including respiratory protection and protective clothing.
- .3 Proper clean-up methods associated with the remediation of fungi in indoor environments

9.0 PREPARATION

9.1 PREPARATION: Work Areas

The work area shall be unoccupied (i.e. building occupants/users shall not work in or enter an area where work activity involving fungal remediation takes place).

- .1 HEPA vacuum all objects that will be removed from the work area. Remove all waste as fungal-contaminated material.
- .2 Remove all moveable objects from the work area prior to commencement of work by the abatement contractor.
- .3 Pre-clean all work areas using a HEPA vacuum cleaner or wet cleaning method, where practical. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment. This work shall include the cleaning of all horizontal surfaces, floors, surfaces of immovable objects and any other surfaces where fungal particulates or dust could possibly occur. This work shall be carried out before placing the polyethylene on walls, floors, ducts or machinery.
- .4 Equipment or objects that cannot be removed shall be sealed with 6 mil polyethylene sheeting, sealed with tape suitable for use in wet and dry conditions.
- .5 Isolate or "turn off" the ventilation **to** and **from** the work area to prevent contamination and fungal dispersal to other areas of the building during work phase. Utmost care shall be taken to ensure that when this is done these actions will not affect the heating and ventilation systems supplying adjacent occupied areas.
- .6 Establish negative pressure in work areas. Negative pressure units shall have total rated capacity with filters in place sufficient to provide one air change every 15 minutes or to maintain a minimum pressure differential of 0.02 inches of water column relative to adjacent areas outside of work areas. Operate negative pressure units continuously from the time the first polyethylene is installed to seal openings until final clearance is given. Replace used filters to maintain specified flow rate. Negative air units must discharge directly to the outdoors but not at or near building access points in use by building occupants. Replace HEPA filter as required to

maintain flow rate and integrity of units. **Note:** All units must be DOP tested on site, immediately prior to initial usage, when HEPA filters are changed and after unit has been transported to a new location.

- .7 All openings within the work area shall be double sealed with two layers of 6 mil polyethylene sheet. Such openings shall in general encompass, but not be restricted to ducts, vents, grilles, floor drains, skylights, windows, doors, electrical ducts and boxes.
- .8 Wall and floor surfaces including temporary partitions shall be protected with continuous sheets of polyethylene, to be overlapped at least 0.3 m(1ft) and sealed with tape on both sides. On all floor surfaces, install a minimum of one layer of rip-proof polyethylene covered by one layer of 6 mil polyethylene. The polyethylene laid on the floor shall extend continuously up walls for a minimum of 0.3 m (1ft). No taped joints between floor and wall polyethylene will be permitted at the actual junction of floor and walls. Polyethylene on walls shall extend down to overlap the polyethylene from the floor and be taped and sealed securely to this floor covering, overlapping a minimum of 0.2 m (1/2ft). 6mil polyethylene shall be used on walls.
- .9 Build airlocks at all entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.
- .10 At each access to the external clean areas, post signs warning of the fungal hazard.

9.2 **PREPARATION: Decontamination Enclosure System**

Decontamination Enclosure System should be comprised of a Decontamination Room and a Clean Room, as follows:

- .1 ***Decontamination Room:*** build a Decontamination Room between the Clean Room and work area(s), with two curtained doorways, one to the Clean Room and one to the work area(s). Provide a waste receptor, and storage facilities for workers' protective clothing to be re-worn in work areas. The Decontamination Room shall be large enough to accommodate specified facilities, any other equipment needed and at least one worker allowing him/her sufficient space to undress comfortably. All contaminated clothing must be removed prior to entering the Clean Room.
- .2 ***Clean Room:*** build a Clean Room between the Decontamination Room and the external clean areas, with two curtained doorways, one to the Decontamination Room and one to the external areas outside of the enclosure system. Provide lockers or hangers for workers street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install a mirror to permit workers to fit respiratory equipment properly, and sufficient hangers and hooks. Depending on the size of the work crew, provide a minimum of two wash stations consisting of at least a basin, fresh water, soap and towels (one for workers and one for respirators). (Note: washbasins should be emptied and refilled periodically throughout the day). Provide benches for workers to sit on while changing. No fungal-contaminated items should be brought into this room.

9.3 **PREPARATION: Construction of Decontamination Enclosure System**

- .1 Build suitable framing for enclosures and line with polyethylene sheeting sealed with tape. Use a minimum of one layer of rip-proof polyethylene on floors.

- .2 Ensure that design and location of entrance to facility is satisfactory to owner.
- .3 Build curtained doorways between enclosures (airlock) so that when people move through or when waste containers and equipment are moved through a doorway, one of the two closures comprising the doorway always remains closed.

9.4 PREPARATION: Separation of Work Areas from Occupied Areas

- .1 Separate parts of the building required to remain in use from parts of the building where fungal remediation will take place by means of a barrier system constructed as follows:
 - .1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 3/8" minimum thick plywood. Seal all joints with surface film forming type sealer.
 - .2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.

9.5 PREPARATION: Maintenance of Enclosures

- .1 Maintain enclosures in tidy condition.
- .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- .3 Visually inspect enclosures at the beginning of each shift, end of each shift and at least once each day when no shifts are running.
- .4 Use smoke methods to test effectiveness of barriers when directed by consultant.

9.6 PREPARATION: Fungal Remediation Work Shall Not Commence Until:

- .1 Work areas, the decontamination enclosure system and parts of the building required to remain in use are effectively segregated.
- .2 Tools, equipment and materials waste receptors are on hand.
- .3 Arrangements have been made for ventilation system "shut down".
- .4 Warning signs are displayed at each access to external clean areas.
- .5 All notifications have been completed and other preparatory steps have been taken.
- .6 All submittals have been approved.

10.0 FUNGAL REMEDIATION AND DISPOSAL

- .1 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 contaminated can be cleaned and reused. Cleaning shall be done using a HEPA vacuum, followed by cleaning of the surfaces with a detergent solution. The University may require more stringent cleaning requirements depending on the specific environmental conditions and affected materials involved in the mould abatement. These requirements (e.g. the use of warrior/isocare commercial microbial remediation systems etc.) will be specified by the Office of Environmental Health and Safety prior to the remediation. Porous materials that cannot be adequately cleaned, such as ceiling tiles and insulation, and wallboards with more than a small area of contamination shall be removed and discarded; dust suppression methods, such as misting (not soaking) these porous materials prior to removal and disposal shall be used. Porous materials (e.g. wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded, if possible.

- .2 Remove any porous substrate materials (ceiling tiles, drywall, etc.) to a point beyond the immediate areas of visible contamination, for a minimum distance of 30 cm in all directions.
- .3 All materials to be reused must be dry and visibly free from fungal contamination.
- .4 All materials that cannot be cleaned shall be placed in 6 mil. sealable polyethylene bags within the work area.
- .5 The outside of the bags shall be cleaned with a damp cloth and a cleaning/detergent solution or HEPA vacuumed in the Decontamination Room and double bagged prior to their transport to external clean areas outside the enclosure. **There are no special requirements for the disposal of fungal-contaminated materials.**
- .6 The work area and Decontamination Room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a cleaning/detergent solution, and be visibly clean prior to the removal of the polyethylene plastic enclosures. Polyethylene plastic that will not be reused must be double bagged and disposed of as contaminated waste.

APPENDIX A

INSPECTION REPORTS OF LEVEL III FUNGAL REMEDIATION OPERATIONS

Written daily inspection reports must be signed and submitted by the consultant to the Project Co-ordinator, Facilities and Services within 24 hrs. of completing the inspections for that day.

Prior to commencing fungal remediation the consultant must:

- 1) Review contractor's drawings showing layout of proposed enclosures including decontamination facilities, proposed location of negative pressure units and their discharge outlets directly to the outdoors, and determine if the actual layout is satisfactory.
- 2) Review HEPA vacuum cleaner(s) and negative air unit(s) performance data submittals (obtain from Project Co-ordinator) and ensure that the units for which the data is available are the ones that will be used on the project (check serial nos.).
Note: Performance data includes a written record, which includes the following:
 - Date and time of test;
 - Serial number of equipment;
 - Particle count of tested equipment for 0.3 micron particles;
 - Owner or operator of equipment;
 - Signature of qualified tester.
- 3) Thoroughly inspect and where appropriate, test the seals and construction (see 8.1.7 and 8.1.8) of all polyethylene enclosures:
 - Work area enclosure.
 - Decontamination Enclosure System.
- 4) Ensure that negative air systems are functioning properly and providing the appropriate air change rate.
- 5) Ensure that appropriate signage is properly located at each access to external clean areas.

Each daily report should include the following considerations:

- 1) document the day being reported;
- 2) report the room(s) or area(s) in which the remediation is taking place;
- 3) a progress report for the room or area (e.g. 25% completed).
- 4) comment on the presence/absence of signs warning of the fungal hazard at each access to external clean areas;
- 5) Comment on seals and maintenance of:
 - 1) Work area enclosure
 - 2) Decontamination Enclosure System
 - visually inspect enclosures at the beginning of each working period
 - use smoke methods to test effectiveness of barriers.

- 6) Comment on negative air -- is it sufficient?
- 7) Comment on the use of the detergent solution -- is it sufficient?
- 8) Comment on the completeness of fungal removal.
- 9) As appropriate, when deficiencies are noted, specify the problem and indicate remedial action(s);
- 10) Significant deficiencies or problems in the remedial process must be promptly reported to the Facilities and Services Co-ordinator (i.e. before the typewritten report is submitted). The co-ordinator will promptly inform the Office of Environmental Health and Safety;
- 11) If there is a "break" in the remedial process, record the date(s) in the next report (this will allow us to determine if we do have all of the inspection reports to that date).

Before a clearance to remove barriers is issued:

1. Thoroughly inspect entire work area to determine if all planned fungal remediation has been completed.
2. Conduct clearance air sampling inside the negative pressure enclosure to confirm that the area is suitable for reoccupation.

Any variances from the above procedure must be approved by the project co-ordinator or the Office of Environmental Health and Safety



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PROCEDURES FOR REMEDIATION OF FUNGI

IN INDOOR ENVIRONMENTS

LEVEL IV a:

**HVAC SYSTEMS
LESS THAN 10 SQ. FT.**

PROCEDURES FOR REMEDIATION OF FUNGI

IN INDOOR ENVIRONMENTS (Level IVa)

When authorized workers conduct activities involving the remediation of fungi in an indoor area, specific precautions are required in order to maintain a safe work environment for workers and other building occupants.

The procedures are based on methods of the New York City Department of Health and Mental Hygiene's *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (2008), WorkSafe Manitoba's *Guide for the Investigation, Assessment, & Remediation of Mould in Workplaces* (2015) and the Environmental Abatement Council of Ontario (EACO)'s *Mould Abatement Guidelines* (2015).

1.0 APPLICATION

These procedures apply to all work involving the remediation of fungi in HVAC systems where the contaminated area is less than 10 sq. ft. The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and contaminated dust from leaving the work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.

2.0 HAZARD COMMUNICATION

It is imperative that all building-users are aware of the planned activities concerning remediation of fungi. The following methods should be used to communicate this message:

.1 *Memorandum to Building Occupants*

This memorandum informs the building occupants of the planned work and in general terms includes the precautionary measures required to maintain a safe work environment for all the building occupants. The memorandum should also include that vacating people from spaces adjacent to the work area is not necessary but is recommended to persons having undergone recent surgery, immune suppressed people and people with chronic inflammatory lung diseases (e.g. asthma, hypersensitivity pneumonitis, and severe allergies).

.2 *Signage in the Building Lobby/Entrance*

The signs will inform/remind all building users that the planned work is in progress and will continue for the specified period.

.3 *Signage at the Work Location*

These signs inform building users that entry into the isolated work area is restricted to authorized personnel only.

3.0 DEFINITIONS

- .1 *HEPA Vacuum:* Vacuum cleaner equipped with High Efficiency Particulate Air Filter, fitted with appropriate tools. The vacuum equipment shall have a filtering system capable of collecting and retaining particles greater than 0.3 microns in diameter at

99.97% efficiency.

- .2 *Damp-Wiping:* A cleaning process for removing residual fungal contamination using damp-cloths, sponges or mops.
- .3 *Misting:* A dust suppression method intended to minimize the spread of mould or spores. Done prior to removal of contaminated material.
- .4 *Polyethylene Sheeting:* 6 mil. thickness, in largest sheet size available to minimize seams.
- .5 *Rip-Proof Polyethylene:* 12 mil. thickness, fibre reinforced and in sheet size to minimize seams.
- .6 *Enclosure:* An impermeable barrier made of polyethylene plastic or similar material, behind which fungal remediation will take place.
- .7 *Polyethylene sheeting sealed with tape:* Polyethylene sheeting of thickness specified, sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to prevent escape of fungal particles through the sheeting into a clean area.
- .8 *Work Areas:* Where actual work activity involving fungal remediation takes place.
- .9 *DOP Test:* Dioctylphthalate aerosol challenge of a HEPA filter system and is used to establish the integrity and effectiveness of the system to filter out particles in the respirable range.

4.0 **PERSONAL PROTECTION**

- .1 *Respirators* All Respiratory equipment shall be individually assigned and identified. Each worker must be instructed and tested with his respirator. During all work that may generate airborne fungal contamination (i.e. including preparatory work, if it is likely that the fungi could be disturbed), workers shall wear **half or full-facepiece respirators with high efficiency particulate air (HEPA) filter cartridges.** Disposable single-use type respirators are **not** permitted. Replace filter cartridges as appropriate. All respirators shall be approved and labelled for protection against particulates and shall meet the design and usage requirements of the National Institute for Occupational Safety and Health (NIOSH). No supervisor or worker shall have **facial hair**, which affects respirator-to-face seal.
- .2 *Protective Clothing:* All workers must be provided with full body disposable coveralls, extra large size with attached hood and elasticized at cuffs and hood, made of material which does not readily retain nor permit penetration of fungal particles. Shoe covers are also required. Appropriate gloves and eye protection must be worn.

- .3 *Facilities:* Provide facilities for washing hands and face, which shall be used by every worker when leaving fungal-contaminated work areas.
- .4 *Practice:* Workers shall not eat, drink, smoke or chew while in contaminated work areas.
- .5 *Enclosure Entry:* All persons shall don respirators with HEPA filters, clean coveralls and appropriate gloves and eye protection before entering work area enclosure.
- .6 *Enclosure Exit:* Before leaving the enclosure and still wearing a respirator, a worker shall:
- Thoroughly HEPA vacuum all exposed skin, protective clothing, respirator, shoes and hair (after removing hood).
 - Remove decontaminated coveralls and wash hands and face with water (in enclosure).
 - Leave the enclosure in street clothes and proceed to the nearest washroom to wash hands and face.
 - Coveralls may be reused throughout a day provided they are disposed of after each shift.
 - Thoroughly wash out respirator between uses.

5.0 TRAINING

Remediation shall be conducted by only those personnel who have received training in:

- .1 The potential health hazards of fungi exposure and other aspects related to the remediation of fungi in indoor environments.
- .2 The proper use of personal protection, including respiratory protection and protective clothing.
- .3 Proper clean-up methods associated with the remediation of fungi in indoor environments.

6.0 PREPARATION: Work Areas

The work area shall be unoccupied (i.e. building occupants/users shall not work in or enter an area where work activity involving fungal remediation takes place).

Before beginning work:

- .1 HEPA vacuum all objects that will be removed from the work area. Remove all waste as fungal-contaminated material.
- .2 Remove all moveable objects from the work area prior to commencement of work by the abatement contractor.
- .3 Pre-clean all work areas using a HEPA vacuum cleaner or wet cleaning method,

where practical. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment. This work shall include the cleaning of all horizontal surfaces, floors, surfaces of immovable objects and any other surfaces where fungal particulate or dust could possibly occur. This work shall be carried out before placing the polyethylene on walls, floors, ducts or machinery.

- .4 Equipment or objects that cannot be removed shall be sealed with 6 mil polyethylene sheeting, sealed with tape suitable for use in wet and dry conditions.
- .5 Provide a temporary enclosure to prevent the spread of airborne dust from the work area. Use a prefabricated enclosure or erect an enclosure constructed of two layers of 6 mil. polyethylene plastic sheeting such that the proposed work is entirely within the enclosure; either erect temporary framing to support polyethylene, or clip and tape polyethylene to ceiling system and the floor. Where appropriate, use rip-proof polyethylene sheeting (12 mil.) for the floor of the enclosure. The enclosure shall be as airtight as conditions permit including the provision of a double overlapping flap at the entrance.
- .6 The enclosure must be kept at negative pressure at all times during the operation, with minimum pressure differential of at least -5Pa relative to the air outside of the enclosure. Locate HEPA vacuum body outside enclosure. Locate vacuum hose within enclosure to provide the negative pressure in enclosure.
Note: All HEPA vacuum cleaners that will operate outside of the containment area must be DOP tested immediately prior to initial usage.
- .7 Isolate or "turn off" the ventilation **to** and **from** the work area to prevent contamination and fungal dispersal to other areas of the building during work phase. Utmost care shall be taken to ensure that when this is done these actions will not affect the heating and ventilation systems supplying adjacent occupied areas.
- .8 All openings within the work area shall be double sealed with two layers of 6 mil. polyethylene sheet. Such openings shall in general encompass, but not be restricted to ducts, vents, grilles, floor drains, skylights, windows, doors, electrical ducts and boxes.
- .9 Mist (not soak) all mould contaminated materials to minimize the spread of mould spores.
- .10 Post signs warning of the fungal hazard at entrances to the work area(s).
- .11 Don respiratory equipment and coveralls as described in 4.1 and 4.2.

7.0 FUNGAL REMEDIATION AND DISPOSAL

- .1 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 contaminated can be cleaned and reused. Cleaning shall be done using a HEPA vacuum, followed by cleaning of the surfaces with a detergent solution. The University may require more stringent cleaning requirements depending on the specific environmental conditions and affected materials involved in the mould abatement. These requirements (e.g. the use of warrior/isocare commercial microbial remediation systems etc.) will be specified by the Office of Environmental Health and Safety prior to the remediation. Porous materials that cannot be adequately cleaned, such as paper on the insulation of interior lined ducts and filters shall be removed and discarded; dust suppression

methods, such as misting (not soaking) these porous materials prior to removal and disposal shall be used. Porous materials (e.g. wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded, if possible.

- .2 Remove any porous substrate materials (ceiling tiles, drywall, etc.) to a point beyond the immediate areas of visible contamination, for a minimum distance of 30 cm in all directions.
- .3 All materials to be reused must be dry and visibly free from fungal contamination.
- .4 All materials that cannot be cleaned shall be double-bagged in 6 mil. polyethylene bags, and securely tied immediately within the work area.
- .5 The outside of the bags shall be cleaned with a damp cloth and a cleaning/detergent solution or HEPA vacuumed in the enclosure prior to their transport to external clean areas. **There are no special requirements for the disposal of fungal-contaminated materials.**
- .6 The work area shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a cleaning/detergent solution, and be visibly clean prior to the removal of the polyethylene plastic enclosures. Polyethylene plastic that will not be reused must be double bagged and disposed of as contaminated waste.



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PROCEDURES FOR REMEDIATION OF FUNGI

IN INDOOR ENVIRONMENTS

LEVEL IV b:

**HVAC SYSTEMS
MORE THAN 10 SQ. FT.**

PROCEDURES FOR REMEDIATION OF FUNGI
IN INDOOR ENVIRONMENTS (Level IVb)

When authorized workers conduct activities involving the remediation of fungi in an indoor area, specific precautions are required in order to maintain a safe work environment for workers and other building occupants.

The procedures are based on methods of the New York City Department of Health and Mental Hygiene's *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (2008), WorkSafe Manitoba's *Guide for the Investigation, Assessment, & Remediation of Mould in Workplaces* (2015) and the Environmental Abatement Council of Ontario (EACO)'s *Mould Abatement Guidelines* (2015).

1.0 APPLICATION

These procedures apply to all work involving the remediation of fungi in HVAC systems where the contaminated area is more than 10 sq. ft. The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and contaminated dust from leaving the work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.

2.0 HAZARD COMMUNICATION

It is imperative that all building-users are aware of the planned activities concerning remediation of fungi. The following methods should be used to communicate this message:

.1 Memorandum to Building Occupants

This memorandum informs the building occupants of the planned work and in general terms includes the precautionary measures required to maintain a safe work environment for all the building occupants. The memorandum should also include that vacating people from spaces adjacent to the work area is not necessary but is recommended to persons having undergone recent surgery, immune suppressed people and people with chronic inflammatory lung diseases (e.g. asthma, hypersensitivity pneumonitis, and severe allergies).

.2 Signage in the Building Lobby/Entrance

The signs will inform/remind all building users that the planned work is in progress and will continue for the specified period.

.3 Signage at the Work Location

These signs inform building users that entry into the isolated work area is restricted to authorized personnel only.

3.0 FACILITIES AND SERVICES CONTACTS

Project Co-ordinator - Name ? (Phone #)

The project co-ordinator is responsible for overseeing the entire project and ensuring that all

parties are aware and perform their respective duties according to the written instructions as detailed in these procedures and the written specifications from Facilities and Services.

The co-ordinator is responsible for approving all submittals (see section 5), and as appropriate, may do this in conjunction with the Office of Environmental Health & Safety.

The co-ordinator will receive and review the consultant's report (see section 4) within 24 hours of (the consultant) completing the inspections for that day.

At the discretion of the co-ordinator, when a significant aberration in remedial work occurs, he/she will promptly submit a report to the Office of Environmental Health and Safety. As appropriate, the co-ordinator will also submit reports to the pertinent Department Chair(s) and the Co-chairs of pertinent Joint Health & Safety Committees.

Ventilation System Co-ordinator - Name ? (Phone #)

This co-ordinator has sole authority to "shut down" and "turn on" the various building ventilation systems, as required.

- .1 The Ventilation System Co-ordinator must certify that ventilation to and from the work area has been "shut down" before the abatement contractor begins any preparatory work.
- .2 The Ventilation System Co-ordinator must be notified by the abatement contractor that all work has been completed before ventilation "to" and "from" the work area can be "turned on".

4.0 WORK INSPECTIONS

The abatement contractor's work will be subject to critical scrutiny by the Facilities and Services Project Co-ordinator and the mould consulting firm of (-- Name --). This consists of random/continuous inspections, which will include assessing enclosure containment and the actual work practices used by the contractor (see Appendix A).

The inspections of work areas during contamination periods will be performed to ensure compliance with the specification and governing authorities' requirements. Any variances from specification and governing authorities' requirements that have not been approved in writing may result in the consultant shutting down the removal operations in the work area until compliance is assured at no cost to the owner.

In the event that the inspections of the work area are found unacceptable by the consultant's standards, the standards specified or required by governing authorities, all re-inspection required to obtain consent to proceed from the consultant will be performed with no cost to the owner. All costs for re-inspection shall be borne by the abatement contractor.

The consulting firm will issue a report to the Facilities and Services Project Co-ordinator within 24 hours of completing the inspections for that day. At the discretion of the co-ordinator, when a significant aberration in remedial work occurs, he/she will promptly submit a report to the Office of Environmental Health and Safety. As appropriate, the co-ordinator will also submit reports to the pertinent Department Chair(s) and the Co-chairs of pertinent Joint Health & Safety Committees.

5.0 SUBMITTALS

Before commencing work on each phase, the abatement contractor shall:

- .1 Submit proof satisfactory to the Project Co-ordinator that all employees have had proper instruction on the hazards of fungi exposure, respirator use, protective clothing, entry and exit from work areas, and all aspects of work procedures and protective measures.
- .2 Submit for review and approval, drawings showing layout of proposed enclosures including decontamination facilities and proposed location of negative pressure unit or units, as well as the discharge directly to the outdoors.
- .3 Submit performance data on all HEPA vacuum cleaners to be used at the worksite(s); include DOP test data that is no more than two (2) months old. All HEPA vacuum cleaners that will be operated outside of the containment area must be DOP tested immediately prior to initial usage.
- .4 Submit performance data on all negative air units; include DOP test data. All units must be DOP tested on site, immediately prior to initial usage, when HEPA filters are changed and after unit has been transported to a new location.
- .5 At the discretion of the Project Co-ordinator, submit documentation, including test results and manufacturer's data sheets (where applicable) for:
 - 1) Detergent solutions
 - 2) Tape
 - 3) Rip-proof polyethylene
- .6 Submit for consideration, all variances from specification and governing authorities' requirement. **Note:** variances will only be considered under exceptional circumstances.

6.0 DEFINITIONS

- .1 *HEPA Vacuum:* Vacuum cleaner equipped with High Efficiency Particulate Air Filter, fitted with appropriate tools. The vacuum equipment shall have a filtering system capable of collecting and retaining particles greater than 0.3 microns in diameter at 99.97% efficiency.
- .2 *Damp-Wiping:* A cleaning process for removing residual fungal contamination using damp-cloths, sponges or mops.
- .3 *Misting:* A dust suppression method intended to minimize the spread of mould or spores. Done prior to removal of contaminated material.
- .4 *Polyethylene Sheeting:* 6 mil. thickness, in largest sheet size available to minimize seams.
- .5 *Rip-Proof Polyethylene:* 12 mil. thickness, fibre reinforced and in sheet size to minimize seams.
- .6 *Enclosure:* An impermeable barrier made of polyethylene plastic or

- similar material, behind which fungal remediation will take place.
- .7 *Polyethylene sheeting sealed with tape:* Polyethylene sheeting of thickness specified, sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to prevent escape of fungal particles through the sheeting into a clean area.
- .8 *Work Areas:* Where actual work activity involving fungal remediation takes place.
- .9 *Negative Pressure system:* One which extracts air directly from work area, filters such extracted air through a High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building. This system shall maintain a minimum pressure differential of 5 Pa (0.02 inches of water column) relative to adjacent areas outside of work areas, be equipped with an alarm to warn of system breakdown, and should be equipped with an instrument to continuously monitor and automatically record (hard copy) pressure differences.
- .10 *Curtained doorway:* An arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed by placing two overlapping sheets of polyethylene over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. All free edges of polyethylene shall be reinforced with duct tape and the bottom edge shall be weighted to ensure proper closing. Each polyethylene sheet shall overlap openings not less than 1.5 m (5ft) on each side.
- .11 *Airlock:* A system for permitting ingress or egress without permitting air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways at least 2 m (6.5ft) apart.
- .12 *DOP Test:* Dioctylphthalate aerosol challenge of a HEPA filter system and is used to establish the integrity and effectiveness of the system to filter out particles in the respirable range.

7.0 **PERSONAL PROTECTION**

- .1 *Respirators* All Respiratory equipment shall be individually assigned and identified. Each worker must be instructed and tested with his respirator. During all work that may generate airborne fungal contamination (i.e. including preparatory work, if it is likely that the fungi could be disturbed), workers shall wear **half or full-facepiece respirators with high efficiency particulate air (HEPA) filter cartridges.** Disposable single-use type respirators are **not** permitted. Replace filter

cartridges as appropriate. All respirators shall be approved and labelled for protection against particulates and shall meet the design and usage requirements of the National Institute for Occupational Safety and Health (NIOSH). No supervisor or worker shall have **facial hair**, which affects respirator-to-face seal.

.2 *Protective Clothing:*

All workers must be provided with full body disposable coveralls, extra large size with attached hood and elasticized at cuffs and hood, made of material which does not readily retain nor permit penetration of fungal particles. Shoe covers are also required. Alternately, reusable protective clothing may be used if it is left in the Decontamination Room until the end of the abatement work, at which time such items shall be disposed of as fungal-contaminated waste.

Appropriate gloves and eye protection must be worn.

.3 *Each worker shall:*

.1

Remove street clothes in the Clean Room and put on respirator with new filters or reusable filters, clean coveralls, head covers and shoe covers before entering Decontamination Room or work area. If reusable protective clothing is used each worker shall don respiratory protection only before entering the Decontamination Room where clothing is stored. All street clothes, uncontaminated footwear, towels, and similar uncontaminated articles shall be stored in the Clean Room.

.2

Remove gross contamination from clothing before leaving work area then proceed to Decontamination Room and remove all clothing except respirators. Place contaminated coveralls and shoe covers that will not be reused in receptacles for disposal with other fungal-contaminated materials. Reusable protective clothing and work footwear must be HEPA vacuumed and/or damp-wiped prior to removal. Leave reusable items except respirator in the Decontamination Room. Clean the outside of the respirator; remove respirator, remove filters and store those that will be reused; dispose of those that will be discarded in the waste receptacle; wash and rinse the inside of the respirator. Upon completion of the remedial operations, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from the Decontamination Room.

.3

Following personal decontamination, proceed to Clean Room and dress in street clothes before exiting the Clean Room into the external clean area outside the enclosure system. If re-entering work area, follow procedures outlined in 7.3.1 above.

.4

Be fully protected with the appropriate respirator (see 7.1) and protective clothing (see 7.2) during preparation of the system of enclosures prior to commencing actual fungal remediation.

8.0 TRAINING

Remediation shall be conducted by only those workers who have received training in:

- .1 The potential health hazards of fungi exposure and other aspects related to the remediation of fungi in indoor environments.
- .2 The proper use of personal protection, including respiratory protection and protective clothing.
- .3 Proper clean-up methods associated with the remediation of fungi in indoor environments.

9.0 PREPARATION

9.1 PREPARATION: Work Areas

The work area shall be unoccupied (i.e. building occupants/users shall not work in or enter an area where work activity involving fungal remediation takes place).

- .1 HEPA vacuum all objects that will be removed from the work area. Remove all waste as fungal-contaminated material.
- .2 Remove all moveable objects from the work area prior to commencement of work by the abatement contractor.
- .3 Pre-clean all work areas using a HEPA vacuum cleaner or wet cleaning method, where practical. Do not use methods that raise dust, such as dry sweeping or vacuuming using other than HEPA vacuum equipment. This work shall include the cleaning of all horizontal surfaces, floors, surfaces of immovable objects and any other surfaces where fungal particulates or dust could possibly occur. This work shall be carried out before placing the polyethylene on walls, floors, ducts or machinery.
- .4 Equipment or objects that cannot be removed shall be sealed with 6 mil polyethylene sheeting, sealed with tape suitable for use in wet and dry conditions.
- .5 Isolate or "turn off" the ventilation **to** and **from** the work area to prevent contamination and fungal dispersal to other areas of the building during work phase. Utmost care shall be taken to ensure that when this is done these actions will not affect the heating and ventilation systems supplying adjacent occupied areas.
- .6 Establish negative pressure in work areas. Negative pressure units shall have total rated capacity with filters in place sufficient to provide one air change every 15 minutes or to maintain a minimum pressure differential of 0.02 inches of water column relative to adjacent areas outside of work areas. Operate negative pressure units continuously from the time the first polyethylene is installed to seal openings until final clearance is given. Replace used filters to maintain specified flow rate. Negative air units must discharge directly to the outdoors but not at or near building access points in use by building occupants. Replace HEPA filter as required to maintain flow rate and integrity of units. **Note:** All units must be DOP tested on site, immediately prior to initial usage, when HEPA filters are changed and after unit has been transported to a new location.

- .7 All openings within the work area shall be double sealed with two layers of 6 mil polyethylene sheet. Such openings shall in general encompass, but not be restricted to ducts, vents, grilles, floor drains, skylights, windows, doors, electrical ducts and boxes.
- .8 Wall and floor surfaces including temporary partitions shall be protected with continuous sheets of polyethylene, to be overlapped at least 0.3 m(1ft) and sealed with tape on both sides. On all floor surfaces, install a minimum of one layer of rip-proof polyethylene covered by one layer of 6 mil polyethylene. The polyethylene laid on the floor shall extend continuously up walls for a minimum of 0.3 m (1ft). No taped joints between floor and wall polyethylene will be permitted at the actual junction of floor and walls. Polyethylene on walls shall extend down to overlap the polyethylene from the floor and be taped and sealed securely to this floor covering, overlapping a minimum of 0.2 m (1/2ft). 6mil polyethylene shall be used on walls.
- .9 Build airlocks at all entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.
- .10 At each access to the external clean areas, post signs warning of the fungal hazard.

9.2 **PREPARATION: Decontamination Enclosure System**

Decontamination Enclosure System should be comprised of a Decontamination Room and a Clean Room, as follows:

- .1 ***Decontamination Room:*** build a Decontamination Room between the Clean Room and work area(s), with two curtained doorways, one to the Clean Room and one to the work area(s). Provide a waste receptor and storage facilities for workers' protective clothing to be re-worn in work areas. The Decontamination Room shall be large enough to accommodate specified facilities, any other equipment needed and at least one worker allowing him/her sufficient space to undress comfortably. All contaminated clothing must be removed prior to entering the Clean Room.
- .3 ***Clean Room:*** build a Clean Room between the Decontamination Room and the external clean areas, with two curtained doorways, one to the Decontamination Room and one to the external areas outside of the enclosure system. Provide lockers or hangers for workers street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install a mirror to permit workers to fit respiratory equipment properly, and sufficient hangers and hooks. Depending on the size of the work crew, provide a minimum of two wash stations consisting of at least a basin, fresh water, soap and towels (one for workers and one for respirators). (Note: wash basins should be emptied and refilled periodically throughout the day). Provide benches for workers to sit on while changing. No fungal-contaminated items should be brought into this room.

9.3 **PREPARATION: Construction of Decontamination Enclosure System**

- .1 Build suitable framing for enclosures and line with polyethylene sheeting sealed with tape. Use a minimum of one layer of rip-proof polyethylene on floors.
- .2 Ensure that design and location of entrance to facility is satisfactory to owner.
- .3 Build curtained doorways between enclosures (airlock) so that when people move

through or when waste containers and equipment are moved through a doorway, one of the two closures comprising the doorway always remains closed.

9.4 PREPARATION: Separation of Work Areas from Occupied Areas

- .1 Separate parts of the building required to remain in use from parts of the building where fungal remediation will take place by means of a barrier system constructed as follows:
 - .1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 3/8" minimum thick plywood. Seal all joints with surface film forming type sealer.
 - .2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.
 - .3 Cover the ducts leading to the uncontaminated area of the HVAC system with polyethylene sheet and seal with tape.

9.5 PREPARATION: Maintenance of Enclosures

- .1 Maintain enclosures in tidy condition.
- .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- .3 Visually inspect enclosures at the beginning of each shift, end of each shift and at least once each day when no shifts are running.
- .4 Use smoke methods to test effectiveness of barriers when directed by consultant.

9.6 PREPARATION: Fungal Remediation Work Shall Not Commence Until:

- .1 Work areas, the decontamination enclosure system and parts of the building required to remain in use are effectively segregated.
- .2 Tools, equipment and materials waste receptors are on hand.
- .3 Arrangements have been made for ventilation system "shut down".
- .4 Warning signs are displayed at each access to external clean areas.
- .5 All notifications have been completed and other preparatory steps have been taken.
- .6 All submittals have been approved.

10.0 FUNGAL REMEDIATION AND DISPOSAL

- .1 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 contaminated can be cleaned and reused. Cleaning shall be done using a HEPA vacuum, followed by cleaning of the surfaces with a detergent solution. Porous materials that cannot be adequately cleaned, such as paper on the insulation of interior lined ducts and filters

shall be removed and discarded; dust suppression methods, such as misting (not soaking) these porous materials prior to removal and disposal shall be used. Porous materials (e.g. Wallboard, and fabrics) that can be cleaned, can be reused, but should but should be discarded, if possible

- .2 Remove any porous substrate materials (ceiling tiles, drywall, etc.) to a point beyond the immediate areas of visible contamination, for a minimum distance of 30 cm in all directions.
- .3 All materials to be reused must be dry and visibly free from fungal contamination.
- .4 All materials that cannot be cleaned shall be placed in 6 mil. sealable polyethylene bags within the work area.
- .5 The outside of the bags shall be cleaned with a damp cloth and a cleaning/detergent solution or HEPA vacuumed in the Decontamination Room and double bagged prior to their transport to external clean areas outside the enclosure. **There are no special requirements for the disposal of fungal-contaminated materials.**
- .6 The work area and Decontamination Room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a cleaning/detergent solution, and be visibly clean prior to the removal of the polyethylene plastic enclosures. Polyethylene plastic that will not be reused must be double bagged and disposed of as contaminated waste.

APPENDIX A

INSPECTION REPORTS OF LEVEL IVb FUNGAL REMEDIATION OPERATIONS

Written daily inspection reports must be signed and submitted by the consultant to the Project Co-ordinator, Facilities and Services within 24 hrs of completing the inspections for that day.

Prior to commencing fungal remediation the consultant must:

- 1) Review contractor's drawings showing layout of proposed enclosures including decontamination facilities, proposed location of negative pressure units and their discharge outlets directly to the outdoors, and determine if the actual layout is satisfactory.
- 2) Review HEPA vacuum cleaner(s) and negative air unit(s) performance data submittals (obtain from Project Co-ordinator) and ensure that the units for which the data is available are the ones that will be used on the project (check serial nos.).
Note: Performance data includes a written record, which includes the following:
 - Date and time of test;
 - Serial number of equipment;
 - Particle count of tested equipment for 0.3 micron particles;
 - Owner or operator of equipment;
 - Signature of qualified tester.
- 3) Thoroughly inspect and where appropriate, test the seals and construction (see 8.1.7 and 8.1.8) of all polyethylene enclosures:
 - Work area enclosure.
 - Decontamination Enclosure System.
- 4) Ensure that negative air systems are functioning properly and providing the appropriate air change rate.
- 5) Ensure that appropriate signage is properly located at each access to external clean areas.

Each daily report should include the following considerations:

- 1) document the day being reported;
- 2) report the room(s) or area(s) in which the remediation is taking place;
- 3) a progress report for the room or area (e.g. 25% completed).
- 6) comment on the presence/absence of signs warning of the fungal hazard at each access to external clean areas;
- 7) Comment on seals and maintenance of:
 - 1) Work area enclosure
 - 2) Decontamination Enclosure System
 - visually inspect enclosures at the beginning of each working period
 - use smoke methods to test effectiveness of barriers.

- 6) Comment on negative air -- is it sufficient?
- 7) Comment on the use of the detergent solution -- is it sufficient?
- 8) Comment on the completeness of fungal removal.
- 9) As appropriate, when deficiencies are noted, specify the problem and indicate remedial action(s);
- 10) Significant deficiencies or problems in the remedial process must be promptly reported to the Facilities and Services Co-ordinator (i.e. before the typewritten report is submitted). The co-ordinator will promptly inform the Office of Environmental Health and Safety;
- 12) If there is a "break" in the remedial process, record the date(s) in the next report (this will allow us to determine if we do have all of the inspection reports to that date).

Before a clearance to remove barriers is issued:

1. Thoroughly inspect entire work area to determine if all planned fungal remediation has been completed.
2. Conduct clearance air sampling inside the negative pressure enclosure to confirm that the area is suitable for reoccupation.

Any variances from the above procedure must be approved by the project co-ordinator or the Office of Environmental Health and Safety