

RPF Environmental Offers:

- Training
- Industrial Hygiene
- Hazardous Materials
- Asbestos
- Lead
- Indoor Air Quality
- Mold
- Silica Exposure
- Legionella
- Water Testing
- Hazard Communication
- Safety Management
- Machine Guarding
- Confined Space
- Mock OSHA Inspections
- Compliance and Safety Reviews
- Risk Assessments
- Emergency Response Planning
- Onsite Staffing
- Accident Investigations
- Job Safety Analysis

MOLD AWARENESS

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Training Objectives

1. Understand Fungi
2. Causes of Fungal Contamination
3. Prevent Fungal Contamination
4. Recognize Fungal Contamination
5. Evaluate Fungal Contamination
6. Remediate Fungal Contamination
7. Verify Fungal Remediation

Understand Fungi

What is Mold?



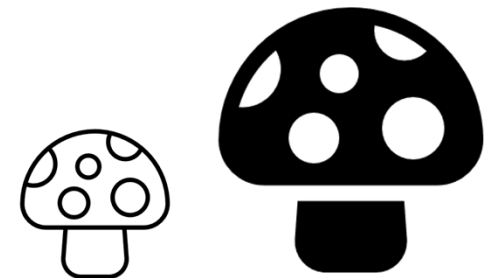
- General term used for fungi that produce asexual spores
- Artificial grouping similar to the term “weed”
- No taxonomic significance
- Generally refers to a visible colony of fungi growing in an indoor environment.

Fungi is classified as a Kingdom

- Animals
- Plants
- Bacteria
- Protists (Ameboea, Algae, among others)
- Fungi

Kingdom of Fungi

Molds	Mildews	Yeast	Mushrooms
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Understanding Fungi

- Mold - Fungi with fuzzy, cotton-like, wooly or powdery colonies
- Mushrooms – Large fungal body
- Fungi
- absorb nutrients by attacking dead organic matter
- utilize enzymes to dissolve food source
- aerobic versus anaerobic
- sensitive to light
- most require elevated humidity or moisture levels

Roles of Fungi

- Decomposers of dead plants and animals
- Sources of antibiotics (penicillium)
- Food production
- Adverse impacts – food spoilage, mycoses, toxin production



Aerotech Laboratories, Inc.

Stachybotrys spp.



Aerotech Laboratories, Inc.



FUNGI

100,000 +/-

Different
species

1,000 +/-

Species
common
to the USA

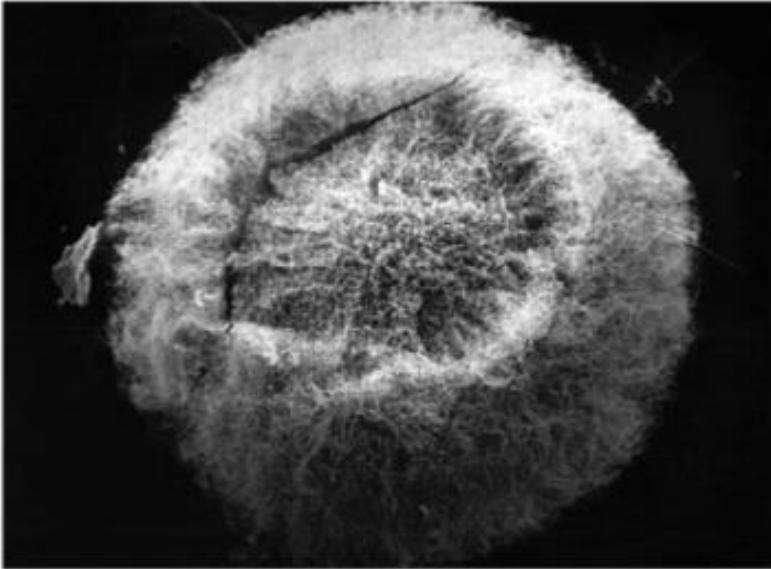
100 +/-

Species
associates
with
infections

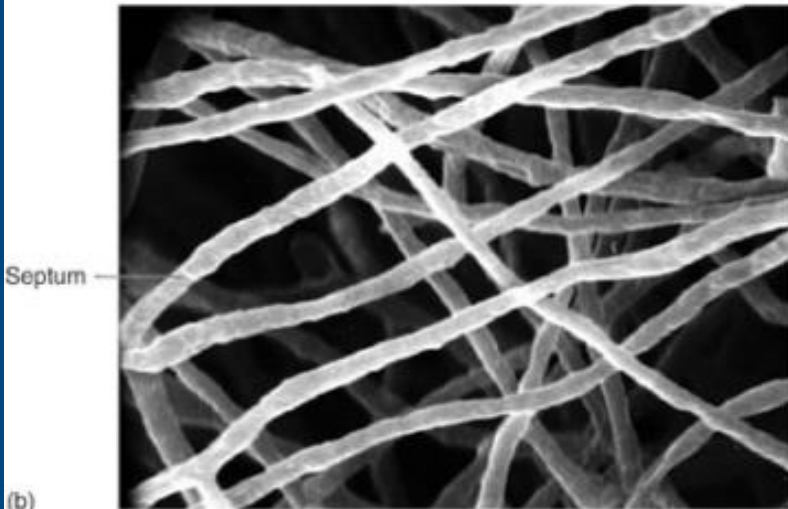
Some of the most common molds
that cause allergies include:
alternaria, aspergillus,
cladosporium and penicillium

Molds (hyphae)

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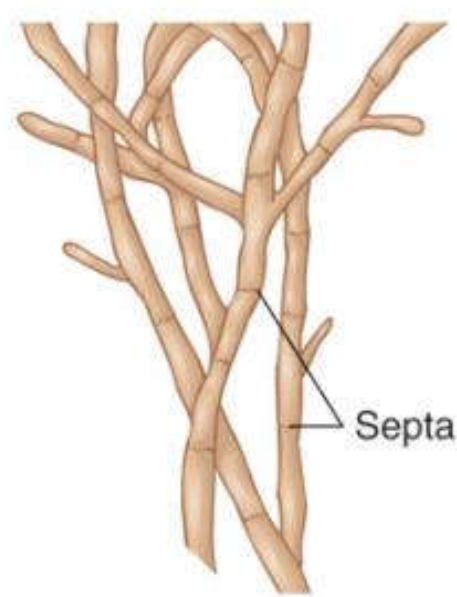


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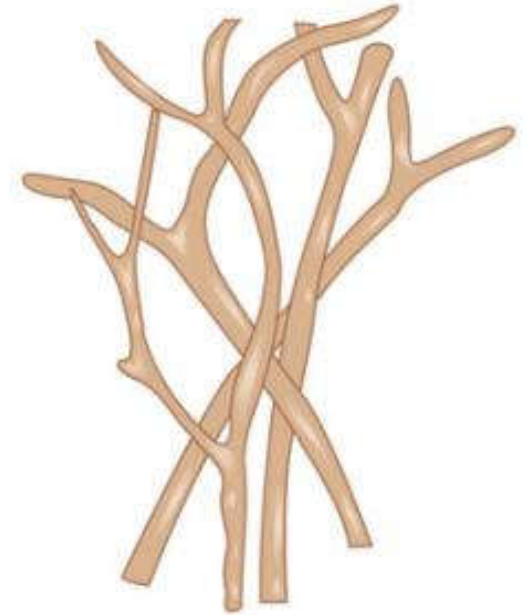
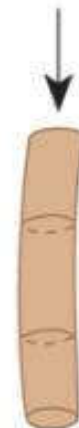
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Septate hyphae

as in *Penicillium*



Nonseptate hyphae

as in *Rhizopus*



(c)



Common Fungi

1. Penicillium – approximately 200 species useful to man, but several species can produce multiple and varied toxins.
2. Stachybotrys chartarum (atra) – often called the black mold, produces mycotoxins including tricothecenes, T-2 toxins



Common Health Effects

- Sneezing
- Runny nose
- Cough and postnasal drip
- Itchy eyes, nose and throat
- Watery eyes
- Dry, scaly skin



More Severe Health Effects

- Mold-induced Asma
- Allergic Fungal Sinusitis
- Allergic Bronchopulmonary Aspergilliosis
- Hypersensitivity pneumonitis



Fungi

- Require nutrients, organic matter
- Moisture or high relative humidity (>60%)
- Temperature between 40-100°F
- Source of spores



Fungi Nutrients

- Common Building Products-ceiling tiles
- Wood
- Cellulose
- Sheetrock
- Books/Papers
- Carpets
- Furniture
- Fabrics and Upholstery
- Latex Paint
- Dust/Debris within HVAC systems

Causes of Fungal Contamination

Leaking Pipes

Floods

Surface and groundwater
seepage

Poor Ventilation

Humidity greater than 50%

Prevent Fungal Contamination

- Control Moisture
- Control Nutrient Sources



Prevent Moisture - Homeowners

- Eliminate sources of dampness in basements
 - groundwater seepage
 - surface water runoff
 - leaky pipes
- Improve drainage
 - rain gutters
 - reslope around foundation
- Use a dehumidifier to keep humidity levels less than 50%
 - clean collection bucket and condensation coils
- Use an air conditioner.
- Change filters on furnace and air conditioners regularly.
- Ventilate all bathrooms.
- Do not carpet bathrooms and basements.
- Remove unnecessary nutrient sources such as newspapers and other papers.

Prevent Moisture - Businesses

- Control humidity to 30-50%
- Redesign landscaping to slope water away
- Properly ventilate bathrooms, kitchens, and other damp areas
- Preventative maintenance program for HVAC systems
- Regularly inspect buildings for water damage, visible mold and condensation
- Correct and prevent any underlying causes of water accumulation including condensation
- Thoroughly dry areas with water infiltration within 48 hours

Recognize Fungal Contamination

- Signs of moisture
 - Water staining
 - Bubbling or peeling paint
 - Crumbling wall or ceiling materials
 - Loose flooring materials
- Elevated moisture readings
- Visible suspect growth
 - Spotting or staining on wet building materials





Common Occupations with Mold Exposure

- Farming
- Dairy work
- Logging
- Baking
- Millwork and carpentry
- Greenhouse work
- Winemaking
- Furniture repair



Hidden Areas with Potential Mold

- Backside of dry wall
- Under wallpaper, paneling
- Top of ceiling tiles
- Underside of carpets and pads
- Inside pipe chases and utility tunnels
- In condensate from drain pans
- Porous thermal or acoustic liners inside of ductwork
- Roof materials above ceiling tiles



Why Sample for Mold?

1. When mold is not visible, but there has been a water leak, or there is water discoloration
2. When there is a musty smell, or odor
3. When building occupants have common allergic symptoms that cannot be explained by other sources.
4. To address people's concerns regarding indoor air quality (IAQ) and mold
5. To provide information and guidance for corrective actions
6. The Center for Disease Control (CDC) does not recommend routine sampling for mold.





- Aspergillus/Penicillium like & Ascospores



Evaluate Fungal Contamination

Sampling and Analysis

- Surface
 - Swabs
 - Tape
 - Contact Plates
- Air
 - Impactor – Agar Plates
 - Impactors strips
 - Cassettes/Filters
- Metabolites/Toxins







Sampling and Analysis

- Metabolites/Toxins...
 - *Mycotoxins*: secondary metabolites produced by certain mold species as a toxic defense to protect their food source and territory. These may include: Tricothecenes, Gliotoxins, Alfatoxins and Ochratoxin A.

Sampling and Analysis

- Metabolites/Toxins...
 - *Endotoxins*: derived from the cell walls of Gram-Negative Bacteria (GNB). They don't have to be living, so both living and non-living GNB contribute endotoxins. The health effect of endotoxins depends on the individual, dosage and route of exposure.
 - The benefit of testing for these is to understand the potential toxic load in the indoor environment.

Sampling Continued..

- Wall sampling devices
- Carpet sampling
- Moisture Meter
- Boroscope
- Visual observations in conjunction with laboratory data



Interpretation of Results:

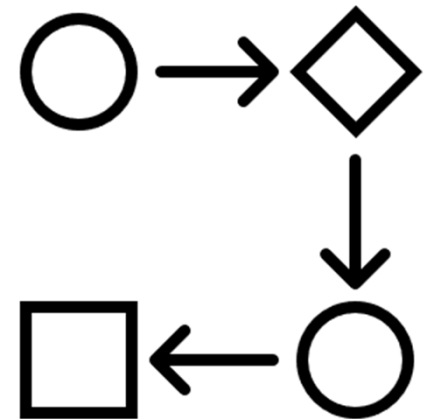
- There are No OSHA Permissible Exposure Limits (PELs)
- There are No ACGIH Threshold Limit Values (TLVs)
- There are No US EPA Standards
- There are No New Hampshire Standards
- Over 50 different bills introduced across USA
- Industrial hygiene air sampling provides a “snapshot” of conditions, which vary:
 - Based on weather, time of day, temperature and life cycle of the fungi present

Interpretation of Results:

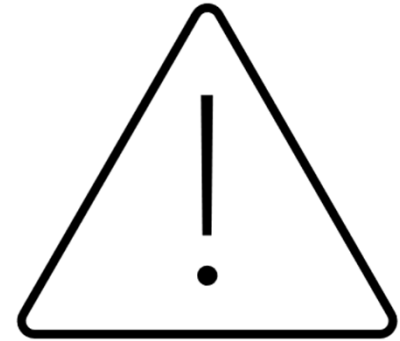
- NIOSH recommends three samples per location
- Compare:
 - Affected or complaint area
 - Unaffected or “clean” area
 - Outside control or ambient air
- Inside should be less than or equal to outside concentrations
- Species found inside should be the same as those found outside.
- Compare pre-abatement to post abatement data

Remediate Fungal Contamination

- ✓ Recognize Fungal Contamination
- ✓ Evaluate Fungal Contamination
- Remediate Fungal Contamination
- Verify Fungal Remediation



Fungal Remediation Worker Hazards



- Exposure to fungi, spores, microbial volatile organic compounds and mycotoxins/endotoxins cause eye, skin and respiratory hazards – proper engineering controls, PPE and decontamination are *key*.
- Heat stress/illness
- Possible fall hazards

- Verify working area is well ventilated.
- Use approved respiratory protection.
- Use hand and eye protection (non-vented goggles).
- Wear long protective gloves.
- Wear protective clothing to prevent contamination and skin contact with mold and chemicals.
- Do not eat, drink, or smoke in work areas.
- After working, wash thoroughly, including hair, scalp and nails.

Worker Protection



Remediation – Step 1.

Identify the Source of Moisture

Identify
source(s) of
moisture

Fix moisture
problem.

Remediation – Step 2.

Assessing Building Materials

- Assess size of mold problem and type of mold damaged materials.
- Recognize intrusive work may be required.
- Clean and dry or discard moldy items.
 - Non-porous materials (i.e., concrete, painted surfaces, metal) - cleaned to remove fungi.
 - Semi-porous materials (i.e., solid wood, brick) – cleaned as far as feasible to remove fungi.
 - Porous materials (ceiling tiles, insulation, wall board, carpet) - should be considered for discarding unless immediately cleaned and dried prior to the 48–72-hour window.

Remediation – Step 2.

Assessing Building Materials

- Perform Asbestos, Lead and HazMat surveys of the impacted areas/materials as needed
- Duct cleaning is questionable and only if substantial growth is observed.

Remediation – Step 3. Select a Team

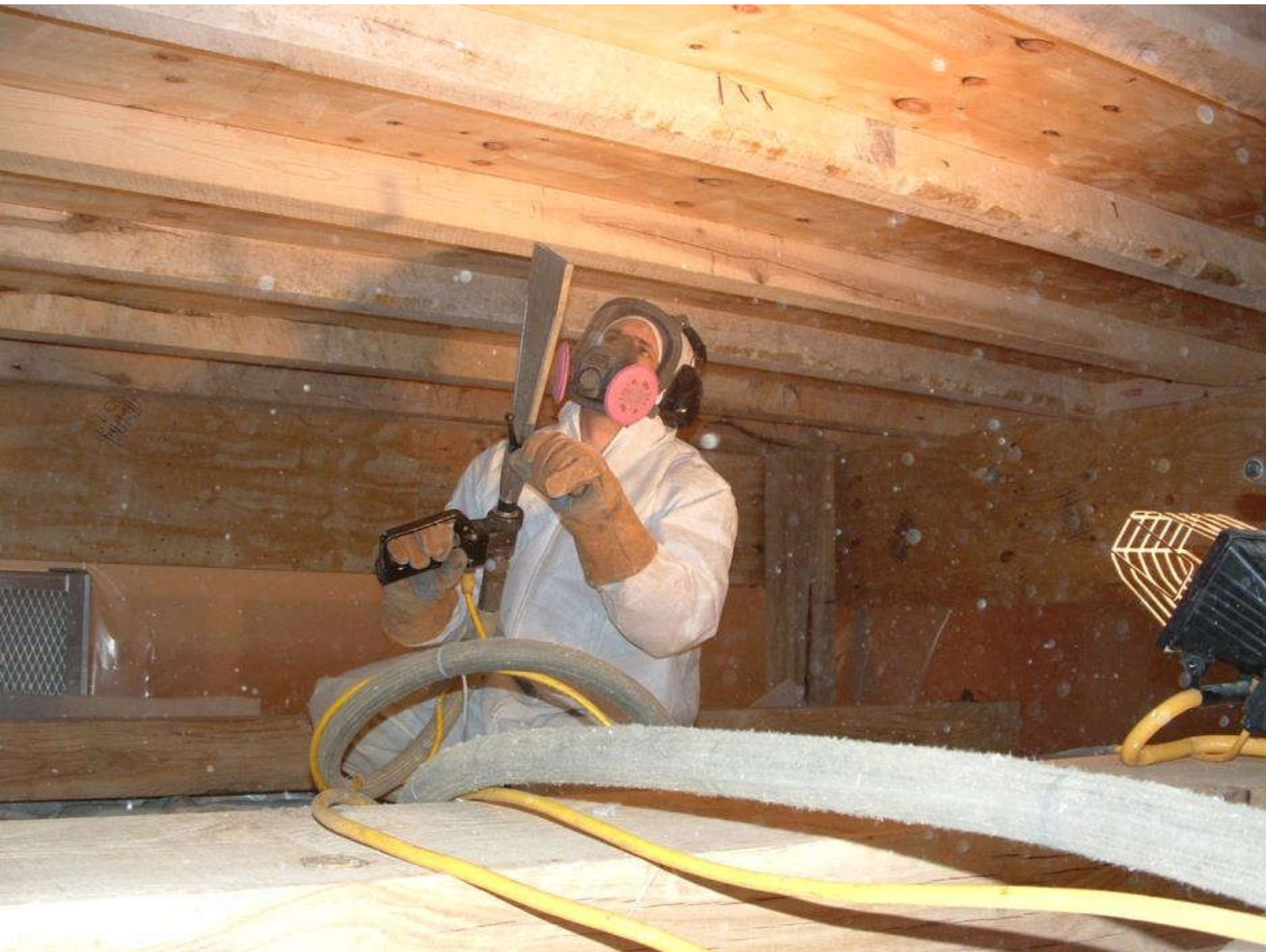
- There is no license for remediation.
- Methodology is similar to asbestos and lead abatement.
- Big question to ask is “can my maintenance/facilities team handle this or do I need a professional?”

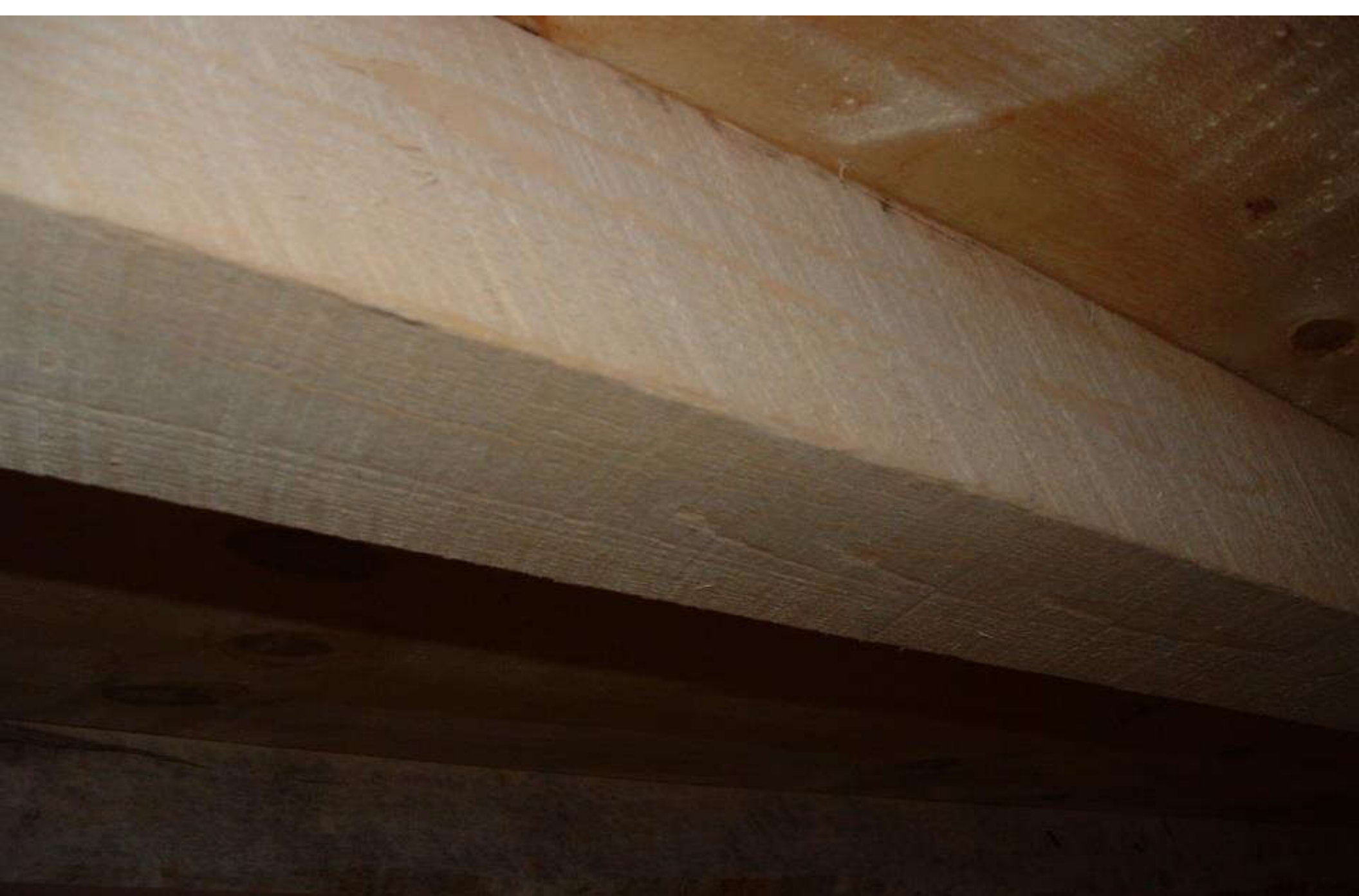
Remediation – Step 4.

Containment Controls

- The goal is to keep mold spores from spreading to other areas.
- Control methods similar to asbestos and lead abatement are likely applicable.
- Leave area clean and visibly free of dust and debris.
- Negative air machines
- HEPA Vacuums
- Misting to keep spores from becoming airborne (keep the dust down)
- Signage
- Clean top to Bottom
- Consider makeup air – don't want to bring contaminated air into the containment







Courtesy of Granite State Environmental

Remediation – Step 5.

Disinfection

- In many cases, soap and water can be used on non-porous surfaces.
- Chemical solutions could include a diluted bleach, peroxide, or other biocides.
- Fogging is not always necessary.
- Dead fungi can still cause allergic reactions.
- Hyphae and metabolites / mycotoxins can still cause reactions after bleach.



Remediation – Step 6.

Drying

- Structural wood left in place must be dried as soon as feasible
- Test with appropriate meters
 - Non-invasive
 - Invasive pin meters
 - Thermal imaged – “areas for further investigation”
- Relative Humidity 35-50%
- Establish dry standard moisture content – utilize accepted guidelines for “dry” building materials.

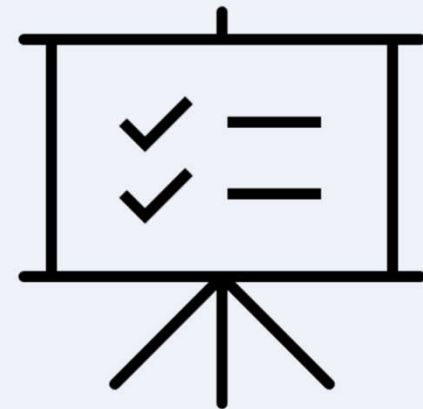
Remediation – Step 7.

Verify Fungal Remediation

- ✓ Recognize Fungal Contamination
- ✓ Evaluate Fungal Contamination
- ✓ Remediate Fungal Contamination
- Verify Fungal Remediation

Post Remediation Verification

- Verify moisture source is corrected
- Verify all materials are dry
- Clean as in white glove test – no visible contamination
- Verify odor free
- Other pre-agreed upon measures
 - Air Testing?
 - Surface Testing?



Not Clean



Not Clean



Not Clean





Clearance Criteria

- ✓ All materials are dry.
- ✓ No visible contamination.
- ✓ No remaining growth.
- ✓ Odor free.
- ✓ Airborne fungal spore concentrations have returned to a “normal fungal ecology”.
- ✓ No surface fungal spores are present.

Overview – In Conclusion

1. Understand Fungi
2. Causes of Fungal Contamination
3. Prevent Fungal Contamination
4. Recognize Fungal Contamination
5. Evaluate Fungal Contamination
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Reference Material

- www.epa.gov/mold
- www.cdc.gov/mold
- www.osha.gov/mold
- www.mayoclinic.org

- Certified Microbial Investigator Course
- Guidelines for the Assessment of Microbiological Contamination in the Indoor Environment, AIHA
- IIRC S520 Standard and Reference Guide for Professional Mold Remediation, Institute of Inspection, Cleaning and Restoration Certification (2015)

THANK YOU!

Questions and comments are welcome.

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