Part 1: Preliminary Assessment

Wednesday, August 29

Condensation on cool surfaces; Consequential large scale mold growth

Keep indoor dew point less than 55°F?

Cellulosic Spray-on Fire Proofing Applied Wet During Construction

Fireproofing that is applied wet to structural surfaces must be allowed to dry within the time frame recommended by the manufacturer

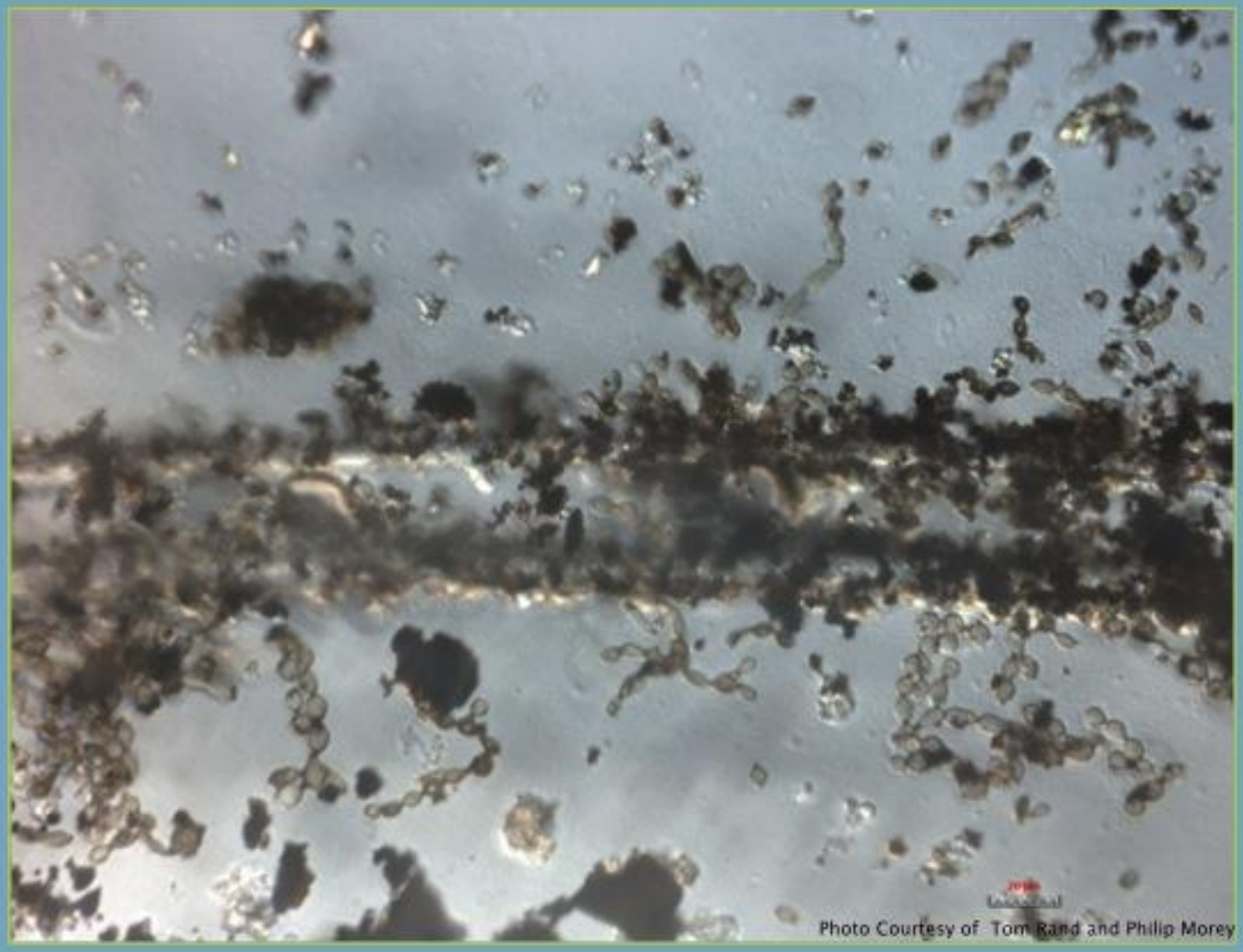
Abundant Stachybotrys spores and conidiophores are present in the wet-applied cellulosic fireproofing sprayed on ceilings and beams in a new building. The moldy fireproofing was removed and replaced with a fireproofing containing a minimal amount of biodegradable components.

Moisture Failure in Crawl Space During Construction

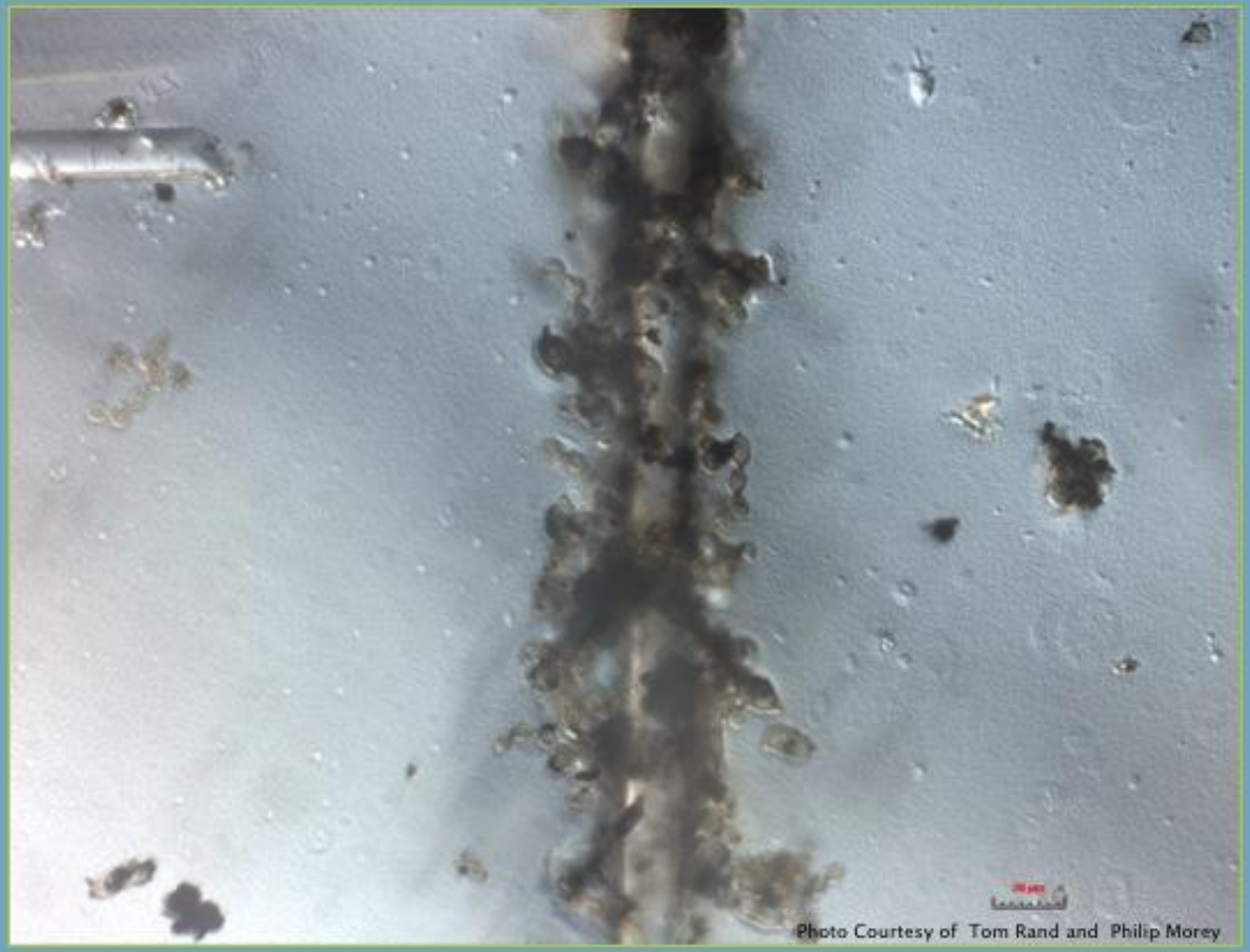
RH in crawl space 75 to 95%; Note mold growth on OSB

What Is All This Fine Particle Dirt On The Airstream Surfaces Of HVAC Air Supply Ducts Doing To IAQ? How Many OLFS?

Dirt Particles on Fiberglass Fibers



Dirt Particles on Fiberglass Fibers



Diagnostic Sampling Considerations

Wednesday August 29 Discussion

Culturable Half Life of Molds? How Accurate?

- When collecting mold spores by filtration, it is important to note that some mold spores (e.g., *Penicillium, Aspergillus, Eurotium* species) have a longer half life or are more desiccation-resistant than other spores (e.g., *Cladosporium, Epicoccum, Stachybotrys* species). See AIHA Field Guide, 2005, pp. 99. Need more study of mold spore half lives.

Dust Samples

- In terms of sampling strategy, pre-determine if dust samples should be collected from above floor surfaces (Pinard et al., 2005, Saratoga Springs Conf., pp 191) or from floor surfaces.
- Pre-determine if dust samples are to be analyzed (for fungi) by direct plating (more ecological important species detected) or dilution plating (may overemphasize species with longest half lives). See AIHA Field Guide, 2005, pp. 120 and 58.

Dust Samples

Stachybotrys in carpet dust assessed by different types of lab analysis:

Analysis	*Stachybotrys* Concentration	%*Stachy* Among Taxa
Dilution on MEA	1×10^3 cfu/g	5%
PCR (24 Target)	1×10^7 spore equivalents/g	> 95%

Morey, 2007, Chapter 3. Which is correct? Can the PCR data be repeated 2 years later?

Mold Remediation Overview

Wednesday August 29 Discussion

Why is it Important to Contain Dusts During Mold Remediation? Rank Order Taxa of Mold Spores Outdoors and Indoors within Containment Prior to and During Removal of Moldy Wallboard (Spore Trap Analysis)

Fungal Taxa	Spores/M^3
Outdoor Air on Roof	
Basidiospores	370
Penicillium/Aspergillus	90
Cladosporium	70
Ascospores	55
Indoors in Room Prior to Removal	
Basidiospores	150
Penicillium/Aspergillus	25
Stachybotrys	25
Cladosporium	10
Ascospores	10
Indoors Within Containment During Removal	
Penicillium/Aspergillus	220,000
Stachybotrys	21,500
Cladosporium	12,000
Ascospores	4,500
Basidiospores	4,250

Sampling period 5-10 minutes except for short term (<0.5 minute) samples collected during demolition; N = 4 to 8. Need excellent PPE. From Morey 2011.

Why is it Important to Contain dusts During Mold Remediation? Rank Order Taxa of Mold Spore Equivalents (SE) in Containment During Mold Remediation and in the Outdoor Air

Fungal Taxa	SE/M^3
<u>Outdoor Air on Roof</u>	
Aspergillus niger	2
Aspergillus fumigatus	1
Cladosporium cladosporioides	1
<u>Indoors Within Containment During Wall Removal</u>	
Stachybotrys chartarum	50,000
Penicillium chrysogenum	4,000
Aspergillus sydowii	2,900
Chaetomium globosum	400
Aspergillus versicolor	100

Note: Air sample collected on fiberglass filter for >1.0 hr.; PCR analysis. Need Excellent PPE! From Morey 2011.

Mold Remediation: Sampling Interpretation Difficulties; Wednesday August 29 Discussion

Rank Order Taxa Concentrations of Culturable Fungi Indoors and Outdoors After Mold Remediation

Fungal Taxa	Average Conc. (CFU/M³)
Outdoor Air on Roof	
Cladosporium cladosporioides	15
Curvularia lunata	11
Penicillium implicatum	5
Penicillium brevicompactum	3
Aspergillus fumigatus	3
Drechslera hawaiiensis	2
Aspergillus japonicus	2
Outdoor Air at Grade Level	
Penicillium brevicompactum	36
Curvularia lunata	18
Alternaria alternata	8
Penicillium implicatum	7
Aspergillus alliaceus	4
Aspergillus japonicus	3
Emericella rugulosa	3
Indoor Air in Formerly Moldy Rooms	
Emericella rugulosa	5
Cladosporium cladosporioides	2
Cladosporium sphaerospermum	2
Penicillium citreonigrum	2
Curvularia lunata	2
Penicillium sclerotiorum	1
Penicillium brevicompactum	1

N = 4 for outdoor air; N = 7 indoor air; laboratory #2 accredited by the American Industrial Hygiene Association, Environmental Microbiology Proficiency Analytical Testing Program. Malt extract agar; culture plate impactor operating at a flow rate of about 0.2m³/minute.
Should outdoor air controls be taken at grade or roof levels? From Morey 2011

Rank Order Taxa Concentrations of Culturable Fungi Indoors and Outdoors Before Mold Remediation. Is it Cladosporium Herbarum or Cladosporium cladosporioides in Outdoor Air?

Fungal Taxa	Average Conc. (CFU/M^3)
<u>Outdoor Air on Roof</u>	
Cladosporium herbarum	298
Aspergillus niger	27
Eurotium amstelodami	22
Cladosporium sphaerospermum	15
Penicillium citrinum	12
Penicillium purpurogenum	12
Penicillium chrysogenum	10
Aspergillus flavus	10
<u>Outdoor Air at Grade Level</u>	
Cladosporium herbarum	261
Alternaria alternata	14
Aspergillus niger	10
Cladosporium sphaerospermum	8
Yeasts, Sporobolomyces	6
<u>Indoor Air in Moldy Rooms</u>	
Wallemia sebi	640
Penicillium brevicompactum	146
Eurotium amstelodami	136
Yeasts, Sporobolomyces	89
Cladosporium sphaerospermum	80
Aspergillus ochraceus	42
Emericella	22
Penicillium citrinum	25

Note: n = 4 for outdoor air; n = 7 indoor air; laboratory #1 accredited by the American Industrial Hygiene Association, Environmental Microbiology Proficiency Analytical Testing Program; culture conditions: Malt extract agar; culture plate impactor operating at a flow rate of about 0.2m3/minute. From Morey 2011.

Rank Order Taxa Of Moulds Detected In The Same Two-Year-Old Dust Sample Using Different Analytical Methods

PCR Analysis	
Stachybotrys chartarum	81%
Penicillium roquefortii	3%
Cladosporium cladosporioides	2.5%
Eurotium amstelodami	2.5%
Aspergillus fumigatus	2.5%
Alternaria alternata	2.5%
Dilution Plating on CMA	
Penicillium spp.	70%
Stachybotrys chartarum	20%
Aspergillus niger	10%
Direct Plating on CMA	
Penicillium spp.	50%
Ulocladium botrytis	20%
Stachybotrys chartarum	10%
Chaetomium globosum	10%
Acrodontium spp.	10%

PCR = Polymerase chain reaction; CMA = cornmeal agar. Dust sample was sieved and homonigized in the laboratory and alequotes of the dust sample were processed separately by PCR, direct plating and dilution plating methods. Which is best? From Morey 2011