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Your Environmental Microbiology Lab

An Introduction to Residential Mold Inspections

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A special thank you to everyone who is joining today's session.

The mission of Assured Bio Labs, LLC is to protect the air that we breathe in our homes and businesses. This is achieved through the lab's two distinctive arms: 1) laboratory analytical services and 2) research and development. The laboratory analytical services arm analyzes data collected by industrial hygienists and inspectors, which test for molds, allergens, bacteria, and viruses at residential, commercial, and industrial locations. Assured Bio strives to provide the best customer service in the field with the fastest turnaround times and accurate data reporting. Through the research and development arm, Assured Bio continually develops products and "new-to-the-world" biotechnology solutions for use in the indoor air quality market and beyond.

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Assured Bio Labs, LLC

Direct Examination Analysis

228 Midway Lane, Suite B
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REVIEWED
by Edward A. Sobek, Ph.D. at 04:49 PM, Sep 28, 2017

Inspector:	Mold Inspector	Date Collected:	Sep/27/2017
Project:	101 Aspergillus Lane, Hyphae, TN 37830	Date Received:	Sep/29/2017
Job Number:	10-11	Date Reported:	Sep/28/2017
Assured Bio Identifier:	MI092917-99	Analyst:	D. Graves

Methods of Analysis

Assured Bio Labs, LLC uses the following Standard Operating Procedures for the analysis of samples:

- Spore Traps - Assured Bio Labs, LLC Document Number 105
- Swabs - Assured Bio Labs, LLC Document Number 106
- Tape Lifts - Assured Bio Labs, LLC Document Number 107
- Bulk Material - Assured Bio Labs, LLC Document Number 108

Interpretation of Spore Trap Results

The Interior vs. the Outside Control: There are currently no national guidelines or standards for the acceptable number of mold spores present in indoor air. It has become the industry standard for professionals to do a comparison between samples collected on the interior of a home or building and the outside control. The fungal spores recovered indoors should be similar in type and number to those collected outside. When this occurs the area is considered to be in equilibrium or is seen as a normal indoor environment. It is very common for multiple samples to be collected on the interior. This is done to pinpoint any problem areas where air quality may be abnormal.

Limit of Detection: This number is the lowest number of spores that can be detected based on the volume of the sample collected.

Background Particulate Density: This rating indicates the presence of airborne particulates other than mold (pollen, dander, insects, ect.). As the Background Particulate Density increases, the ability to visually detect smaller mold spores (such as Penicillium/Aspergillus or Acremonium) decreases. The Level of Debris can be interpreted using the following scale:

- Low - Very little particulate present. Virtually no spores undetectable.
- Low-Medium - Little particulate present. 97% likelihood that all spores have been counted.
- Medium - Moderate level of particulate present. 95% likelihood that all spores have been counted.
- Medium-High - Increased level of particulate present. 75% likelihood that all spores have been counted.
- High - Very heavy particulate. Less than a 75% likelihood that all spores have been counted.

Raw Count: This number is the total number of fungal spores counted under the microscope.

Total Mold Spores: This is an estimate of the fungal spores present per cubic meter of air sampled within that particular sampling location. This number is derived by multiplying the total spores counted on the spore trap by a conversion factor involving the volume of air sampled.

Interpretation of Tape Lift, Swab, or Bulk Material Results

Assured Bio Labs, LLC quantifies the presence of mold spores detected on a tape lift, swab, or bulk sample using the following scale:

Low - Less than 1/3 of the microscopic field of view is obscured by the identified mold spore.

Moderate - Between 1/3 and 2/3 of the microscopic field of view is obscured by the identified mold spore.

High - Over 2/3 of the microscopic field of view is obscured by the identified mold spore.

Abbreviations

ND = None Detected

BDL = Below Detectable Limits

AB Identification Number:	MI092917-99-2	MI092917-99-1
Sample Identification Number:	2	1
Date Collected:	Sep/27/2017	Sep/27/2017
Description:	Master Bedroom	Outside Control
Sample Type:	Spore Trap	Spore Trap
Sample Condition:	Intact	Intact
Comments:	1159179	1159178
Volume/Area Sampled:	150 L	150 L
Reporting Limit:	7	7

Spore Identifications	Raw Count	Spores/m3	Raw Count	Spores/m3
Acremonium-like	ND	BDL	ND	BDL
Alternaria	ND	BDL	ND	BDL
Arthrinium	ND	BDL	ND	BDL
Aspergillus	ND	BDL	ND	BDL
Aureobasidium	ND	BDL	ND	BDL
Botrytis	ND	BDL	ND	BDL
Cercospora-like	ND	BDL	4	27
Chaetomium	ND	BDL	ND	BDL
Cladosporium	45	300	61	407
Coprinus	ND	BDL	ND	BDL
Curvularia	ND	BDL	5	33
Drechslera/Bipolaris Helminthosporium/Exserohilum	ND	BDL	ND	BDL
Epicoccum	ND	BDL	4	27
Fusarium	ND	BDL	ND	BDL
Ganoderma	ND	BDL	ND	BDL
Memnoniella	ND	BDL	ND	BDL
Nigrospora	ND	BDL	ND	BDL
Penicillium	ND	BDL	ND	BDL
Penicillium / Aspergillus - like	28	187	109	727
Pithomyces	ND	BDL	ND	BDL
Scopulariopsis-like	ND	BDL	ND	BDL
Spegazzinia	ND	BDL	ND	BDL
Stachybotrys	ND	BDL	ND	BDL
Tetraploa	ND	BDL	ND	BDL
Torula	ND	BDL	ND	BDL
Trichoderma-like	ND	BDL	ND	BDL
Ulocladium	ND	BDL	ND	BDL
Ascomycetes-unspecified	4	27	289	1927
Basidiomycetes-unspecified	ND	BDL	23	153
Hyphomycetes-unspecified	ND	BDL	12	80
Zygomycetes-unspecified	ND	BDL	ND	BDL
Myxomycetes/Perconia/Smuts/Rusts	ND	BDL	2	13
Miscellaneous structures				
Hyphae	ND	BDL	Present	
Clamydospores	ND	BDL	ND	BDL
Perithecia	ND	BDL	ND	BDL
Sclerotia	ND	BDL	ND	BDL
Background Particulate Density	Low Medium		Medium	
Total Spore Count	77	514	509	3394

AB Identification Number:	MI092917-99-3	MI092917-99-1
Sample Identification Number:	3	1
Date Collected:	Sep/27/2017	Sep/27/2017
Description:	Bathroom	Outside Control
Sample Type:	Spore Trap	Spore Trap
Sample Condition:	Intact	Intact
Comments:	1159180	1159178
Volume/Area Sampled:	150 L	150 L
Reporting Limit:	7	7

Spore Identifications	Raw Count	Spores/m3	Raw Count	Spores/m3
Acremonium-like	ND	BDL	ND	BDL
Alternaria	ND	BDL	ND	BDL
Arthrinium	ND	BDL	ND	BDL
Aspergillus	ND	BDL	ND	BDL
Aureobasidium	ND	BDL	ND	BDL
Botrytis	ND	BDL	ND	BDL
Cercospora-like	ND	BDL	4	27
Chaetomium	ND	BDL	ND	BDL
Cladosporium	98	653	61	407
Coprinus	ND	BDL	ND	BDL
Curvularia	ND	BDL	5	33
Drechslera/Bipolaris Helminthosporium/Exserohilum	ND	BDL	ND	BDL
Epicoccum	ND	BDL	4	27
Fusarium	ND	BDL	ND	BDL
Ganoderma	ND	BDL	ND	BDL
Memnoniella	ND	BDL	ND	BDL
Nigrospora	ND	BDL	ND	BDL
Penicillium	ND	BDL	ND	BDL
Penicillium / Aspergillus - like	679	4527	109	727
Pithomyces	ND	BDL	ND	BDL
Scopulariopsis-like	ND	BDL	ND	BDL
Spegazzinia	ND	BDL	ND	BDL
Stachybotrys	ND	BDL	ND	BDL
Tetraploa	ND	BDL	ND	BDL
Torula	ND	BDL	ND	BDL
Trichoderma-like	ND	BDL	ND	BDL
Ulocladium	ND	BDL	ND	BDL
Ascomycetes-unspecified	42	280	289	1927
Basidiomycetes-unspecified	ND	BDL	23	153
Hyphomycetes-unspecified	ND	BDL	12	80
Zygomycetes-unspecified	ND	BDL	ND	BDL
Myxomycetes/Perconia/Smuts/Rusts	ND	BDL	2	13
Miscellaneous structures				
Hyphae	Present		Present	
Clamydospores	ND	BDL	ND	BDL
Perithecia	ND	BDL	ND	BDL
Sclerotia	ND	BDL	ND	BDL
Background Particulate Density	Low		Medium	
Total Spore Count	819	5460	509	3394

AB Identification Number:	MI092917-99-4	MI092917-99-1
Sample Identification Number:	4	1
Date Collected:	Sep/27/2017	Sep/27/2017
Description:	Basement	Outside Control
Sample Type:	Spore Trap	Spore Trap
Sample Condition:	Intact	Intact
Comments:	1159181	1159178
Volume/Area Sampled:	150 L	150 L
Reporting Limit:	7	7

Spore Identifications	Raw Count	Spores/m3	Raw Count	Spores/m3
Acremonium-like	ND	BDL	ND	BDL
Alternaria	ND	BDL	ND	BDL
Arthrinium	ND	BDL	ND	BDL
Aspergillus	ND	BDL	ND	BDL
Aureobasidium	ND	BDL	ND	BDL
Botrytis	ND	BDL	ND	BDL
Cercospora-like	ND	BDL	4	27
Chaetomium	ND	BDL	ND	BDL
Cladosporium	678	4520	61	407
Coprinus	ND	BDL	ND	BDL
Curvularia	ND	BDL	5	33
Drechslera/Bipolaris Helminthosporium/Exserohilum	ND	BDL	ND	BDL
Epicoccum	ND	BDL	4	27
Fusarium	ND	BDL	ND	BDL
Ganoderma	ND	BDL	ND	BDL
Memnoniella	ND	BDL	ND	BDL
Nigrospora	ND	BDL	ND	BDL
Penicillium	ND	BDL	ND	BDL
Penicillium / Aspergillus - like	245	1633	109	727
Pithomyces	ND	BDL	ND	BDL
Scopulariopsis-like	ND	BDL	ND	BDL
Spegazzinia	ND	BDL	ND	BDL
Stachybotrys	37	247	ND	BDL
Tetraploa	ND	BDL	ND	BDL
Torula	ND	BDL	ND	BDL
Trichoderma-like	ND	BDL	ND	BDL
Ulocladium	ND	BDL	ND	BDL
Ascomycetes-unspecified	4	27	289	1927
Basidiomycetes-unspecified	ND	BDL	23	153
Hyphomycetes-unspecified	6	40	12	80
Zygomycetes-unspecified	ND	BDL	ND	BDL
Myxomycetes/Perconia/Smuts/Rusts	ND	BDL	2	13
Miscellaneous structures				
Hyphae	Present		Present	
Clamydospores	ND	BDL	ND	BDL
Perithecia	ND	BDL	ND	BDL
Sclerotia	ND	BDL	ND	BDL
Background Particulate Density	Medium		Medium	
Total Spore Count	970	6467	509	3394

AB Identification Number:	MI092917-99-5
Sample Identification Number:	5
Date Collected:	Sep/27/2017
Description:	Basement Baseboard
Sample Type:	Swab
Sample Condition:	Intact
Comments:	Black Growth

Spore Identifications	Spore Concentration
Acremonium-like	ND
Alternaria	ND
Arthrinium	ND
Aspergillus	ND
Aureobasidium	ND
Botrytis	ND
Cercospora-like	ND
Chaetomium	ND
Cladosporium	ND
Coprinus	ND
Curvularia	ND
Drechslera/Bipolaris Helminthosporium/Exserohilum	ND
Epicoccum	ND
Fusarium	ND
Ganoderma	ND
Memnoniella	ND
Nigrospora	ND
Penicillium	ND
Penicillium / Aspergillus - like	Medium
Pithomyces	ND
Scopulariopsis-like	ND
Spegazzinia	ND
Stachybotrys	High
Tetraploa	ND
Torula	ND
Trichoderma-like	ND
Ulocladium	ND
Ascomycetes-unspecified	ND
Basidiomycetes-unspecified	ND
Hyphomycetes-unspecified	ND
Zygomycetes-unspecified	ND
Myxomycetes/Perconia/Smuts/Rusts	ND
Miscellaneous structures	
Hyphae	Present
Clamydospores	ND
Perithecia	ND
Sclerotia	ND
Background Particulate Density	Medium

AB Identification Number:	MI092917-99-6
Sample Identification Number:	6
Date Collected:	Sep/27/2017
Description:	Wallpaper Piece
Sample Type:	Bulk
Sample Condition:	Intact
Comments:	From Bathroom

Spore Identifications	Spore Concentration
Acremonium-like	ND
Alternaria	ND
Arthrinium	ND
Aspergillus	ND
Aureobasidium	ND
Botrytis	ND
Cercospora-like	ND
Chaetomium	ND
Cladosporium	Medium
Coprinus	ND
Curvularia	ND
Drechslera/Bipolaris Helminthosporium/Exserohilum	ND
Epicoccum	ND
Fusarium	ND
Ganoderma	ND
Memnoniella	ND
Nigrospora	ND
Penicillium	ND
Penicillium / Aspergillus - like	Low
Pithomyces	ND
Scopulariopsis-like	ND
Spegazzinia	ND
Stachybotrys	ND
Tetraploa	ND
Torula	ND
Trichoderma-like	ND
Ulocladium	ND
Ascomycetes-undefined	ND
Basidiomycetes-undefined	ND
Hyphomycetes-undefined	ND
Zygomycetes-undefined	ND
Myxomycetes/Perconia/Smuts/Rusts	ND
Miscellaneous structures	
Hyphae	ND
Clamydospores	ND
Perithecia	ND
Sclerotia	ND
Background Particulate Density	Medium High

Frequently Occurring Fungi

<i>Acremonium</i>	This organism grows on dead plant material and soil. For growth indoors, it requires very wet conditions. The pathology to humans on exposure includes allergies (eg. hay fever, asthma), pneumonia, and subcutaneous infection.
<i>Alternaria</i>	This can be found on dead and dying plant material. It is easily blown by wind and found in house dust, carpets, textiles, and horizontal surfaces indoors. It can be considered a water impact mold. The pathology to humans on exposure includes allergies and asthma. Other diseases linked to <i>Alternaria</i> include mycotic keratitis, skin infections, and osteomyelitis.
Ascomycetes	This group includes over 3,000 species of fungi which mature in a sack-like structure. They are found everywhere in nature. This group includes <i>Chaetomium</i> and <i>Ascotricha</i> which can frequently found growing indoors on damp substrates. The pathology to humans on exposure is mostly allergenic.
<i>Aspergillus</i>	This can be found growing on forage products, grains, nuts, organic debris and water damaged organic building materials. Pathology to humans includes asthma, but it is less allergenic than other molds. Infections from <i>Aspergillus</i> happen mostly to persons with compromised immune systems. Aspergillosis is the second most common fungal infection requiring hospitalization in US.
<i>Aspergillus</i> <i>/Penicillium</i>	This group of fungal spores includes both the <i>Aspergillus</i> and <i>Penicillium</i> genera. This is because microscopically the two can not be differentiated unless conidiophores (fungal fruiting bodies) are present in the sample. These organisms are very common in the environment; however, an elevated presence can be indicative of a water intrusion event.
Basidiomycetes	This group of fungal spores originates from mushrooms and plant pathogens. They are found in gardens, forests, and woodlands, but basidiomycetes can grow indoors. <i>Serpula lacrimans</i> or "dry rot" and other fungi cause white and brown wood rot. They grow and destroy the structural wood of buildings. The pathology to humans on exposure is mostly allergenic (eg. hay fever, asthma).
<i>Chaetomium</i>	This organism grows on substrates containing cellulose, including paper and plant compost. It is found commonly on damp sheetrock paper. Spores are distinctively shaped and resemble a lemon or a football and mature in a sack-like structure called perithecia. The pathology to humans on exposure includes Type I and III allergens and can produce a mycotoxin shown to cause kidney and liver damage in laboratory animals.
<i>Cladosporium</i>	This genus grows on living and dead plant material, soil, paint, and textiles. It can be found growing in dirty refrigerators and on air conditioning vents. It grows especially well in reservoirs where condensation collects. Often it is found on the surface of fiberglass duct liners in the interior of supply ducts. The spores are generally dispersed by the wind. Water conditions of <i>Cladosporium</i> include houses in damp areas with poor ventilation. It can also be found living on textiles or paper under humid conditions and on moist window frames. Human exposure is rarely pathogenic, but can cause skin lesions, sinusitis, and pulmonary infections. Airborne spores can be significant allergens.
<i>Curvularia</i>	This grows on plant debris and soil. It is a facultative plant pathogen of tropical or subtropical plants and can grow indoors on a variety of substrates, usually under high humidity. The pathology to humans on exposure includes allergies (eg. hay fever, asthma). It is a relatively common cause of allergic fungal sinusitis.

Frequently Occurring Fungi (cont.)

Hyphal Fragments	This is the growing part of fungi. Hyphal fragments present in air samples can be indicative of actively occurring mold growth within the indoor environment.
<i>Memnoniella</i>	This organism is closely related to <i>Stachybotrys</i> and grows on soil, many types of plants, and trees. It is associated often with water intrusion and can grow indoors on many different substrates. It is found frequently in conjunction with <i>Stachybotrys</i> .
<i>Myxomycetes, Periconia, etc.</i>	This group includes Myxomycetes, Rusts, Smuts, and the genus <i>Periconia</i> . These types of fungi are typically found outdoor. Rusts and smuts are often considered plant pathogens or parasites, while myxomycetes are slime molds. These spores are difficult to differentiate microscopically and normally are quantified together.
<i>Penicillium</i>	This fungus grows on materials such as soil, food cellulose, paint, grains, and compost piles. Spores are commonly found in carpet, wallpaper, and in interior fiberglass duct insulation. <i>Penicillium</i> can grow indoors in water-damaged buildings on wallpaper, wallpaper glue, decaying fabrics, moist chipboards, and behind paint. The pathology to humans includes allergies (eg. hay fever, asthma), moldy wall hypersensitivity, and hypersensitivity pneumonitis.
<i>Stachybotrys</i>	This can be found growing on sheet rock, paper, ceiling tiles, cellulose containing insulation backing, and wallpaper. It is a sooty black fungus occasionally accompanied by a thick mass of white mycelia. Conditions for growth include areas subject to temperature fluctuations that also have a relative humidity above 55%. The pathology to human exposure may include allergies, dermatitis, cough, rhinitis, nose bleeds, cold and flu symptoms, headache, general malaise and fever, and diarrhea. It produces mycotoxins which are extremely potent. Toxins produced by the fungus may suppress the immune system-affecting the lymphoid tissue and the bone marrow. Exposure via inhalation, ingestion, or dermal/skin should be avoided.
<i>Ulocladium</i>	This organism grows on plant materials and soils, rotten woods, paper, textiles, and water-damaged building materials. It can be found in dust and air samples. Growth indoors is widespread. It has a high water requirement. The pathology to humans on exposure includes allergies (eg. hay fever, asthma). When this organism is in the presence of <i>Alternaria</i> , symptoms may compound.

Selected References

1. Alexopoulos, C.J. and C.W. Mims. 1979. *Introductory Mycology, Third Edition*. John Wiley & Sons, New York, New York.
2. Barron, G.L. 1968. *The Genera of Hyphomycetes from Soil*. Robert E. Krieger Pub. CO., Malabar, Florida.
3. Ellis, M.B. 1971 *Dematiaceous Hyphomycetes*. CAB International, Wallingford Oxon OX10 8DE, UK.
4. Ellis, M.B. 1976. *More Dematiaceous Hyphomycetes*. CAB International, Wallingford Oxon OX10 8DE, UK.
5. Hanlin, R.T. 1990. *Illustrated Genera of Ascomycetes*. APS Press, St. Paul, Minnesota.
6. Hanlin, R.T. 1998. *Illustrated Genera of Ascomycetes*. II. APS Press, St. Paul, Minnesota.
7. Hanlin R.T. and M.Ulloa. 1988. *Atlas of Introductory Mycology, Second Edition*. Hunter Textbooks, Inc., Winston-Salem, North Carolina.
8. Kiffer E. and M. Morelet. 2000. *The Deuteromycetes: Mitosporic Fungi: Classification and Generic Keys*. Science Publishers, Inc., Enfield, New Hampshire.
9. Macher, J., Ed. 1999. *Bioaerosols: Assessment and Control*. ACGIH, Cincinnati, Ohio.
10. Morris, E.F. 1963. *The Synnematos Genera of the Fungi Imperfecti*. Western Illinois University Publication, Macomb, Illinois.
11. Nelson, P.E., Toussoun, T.A. and W.F.O Marasas. 1983. *Fusarium Species: An Illustrated Manual for Identification*. Pennsylvania State University press, University Park and London.
12. Samson R.A., Hoekstra E.S., Frisvad J.C and O. Fittenborg, Ed. 2002. *Introduction to Food and Airborne Fungi*. Ponsen and Looyen, Wageningen, The Netherlands.
13. Wistreich G.A, 1997. *Microbiology Laboratory: Fundamentals and Applications*. Prentice Hall, Upper Saddle River, New Jersey.

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