American Relative Moldiness Index (ARMI)

228 Midway Lane, Suite B
Oak Ridge, Tennessee 37830
Toll Free: (866) 547-1727
Local: (865) 813-1700
Fax: (865) 813-1705
Email: info@assuredbio.com
www.assuredbio.com

Inspector:	Certified Industrial Hygienist	**Date Collected:**	1/1/2021
Project Name:	Moldy Home	**Date Received:**	1/1/2021
Project Number:	123	**Date Reported:**	1/3/2021
Assured Bio Identifier:	CIH011021-1	**Analyst(s):**	Dr. Jones

Selected References

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Vesper, S., C. McKinstry, P. Ashley, R. Haugland, K. Yeatts, K. Bradhan, and E. Svendsen. 2007. Quantitative PCR analysis of molds in the dust from homes of sthmatic children in North Carolina. Journal of Environmental Monitoring. 9:826-830.

Accreditation

Assured Bio Labs, LLC is accredited by the American Industrial Hygiene Association Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC; Lab ID # 183867) in the Environmental Microbiology accreditation program for "qPCR - Mold Specific qPCR" Fields of Testing as documented by the Scope of Accreditation Certificate and associated Scope. AIHA-LAP, LLC accreditation complies with the ISO/IEC Standard 17025:2005 requirements, but this does not imply ISO certification or registration."

Disclaimer

ARMI analytical data contained within this report only reflects both the historic and current mold burden within the property tested as of the day the sample was collected. Future mold growth is unknown and can be influenced by water intrusion events such as elevated moisture, condensation, structural or plumbing leaks and/or acts of God (major storm events) that occur subsequent to the ARMI test for which results are documented within this report. If a previous mold remediation was conducted in the property for which these results are being reported, conclusions can only be drawn concerning the current mold burden of the property, not the historic mold burden of the property. The effect of a previous mold remediation or clean-up on the current mold burden of the property is subject to a variety of confounding factors, and drawing conclusions regarding the historic mold burden are cautioned against, unless an ARMI test was conducted following the remediation. In such a case, where an ARMI sample was analyzed following mold remediation, the results of this report should be compared to the post remediation ARMI test data to make inference concerning the historical mold burden of the property. Note: Other forms of post remediation (spore-trap, culturable fungi, etc) are invalid for historic comparison with the ARMI test results contained in this report.

Abbreviations

ND = None Detected

Methods of Analysis

Assured Bio Labs uses the following methods for the MSQPCR analysis: CD 23: Data Reporting for MSQPCR Testing, CD 143: Preparation, Processing, and Analysis of MSQPCR Samples, CD 225: Bead Based DNA Extraction

Notes

The American Relative Moldiness Index (ARMI) is a Quantitative, Real-Time Polymerase Chain Reaction (qPCR) panel of testing for indoor molds that was developed by the United States Environmental Protection Agency (US-EPA). This panel includes 10 mold species and groups of species that are known to thrive in water-damaged homes. This panel also includes 3 species and groups of species of molds that are found in all homes, with or without water damage. Each species and group of species is enumerated from DNA extracted from dust samples taken from both the living and sleeping quarters of homes. Concentrations of each of the 13 molds are used to derive an "ARMI Score" that rates the "moldiness" of each sample against those tested by the US-EPA. These values are then compared to the low, moderate, and high moldiness index ranges.

Guidelines to Follow When Interpreting an ERMI SCORE

The Asthma and Allergy Foundation of America has classified the following symptoms for mold allergies: Sneezing, Chronic cough, Runny nose, Nasal congestion, Itchy, watery, and red eyes, Skin rashes and hives, Sinus headaches, Reduced lung capacity and difficulty breathing

Mold-exposure symptoms differ from person to person, depending upon the sensitivities of each individual and their levels of exposure to mold. Persons that are extremely sensitive to mold, or those with suppressed immune systems, could be at higher risk for allergic reactions than those that are less sensitive and have full immune system function. Reaction to mold exposure can be immediate or delayed, depending on the individual and their susceptibility and exposure levels.

The US-EPA has developed a 13-species panel of Mold-Specific Quantitative Polymerase Chain Reaction (MSQPCR) analyses called the American Relative Moldiness Index (ARMI). The ARMI is an abbreviated panel of analyses that are found in the more comprehensive Environmental Relative Moldiness Index (ERMI). House dust is used as the matrix for both the ERMI and ARMI. Quantities of these species in 1 mg of dust are used to derive an "ARMI Score" that rates the moldiness of a home, based upon scores from approximately 1100 homes tested in the US. Assured Bio Labs, LLC recognizes three broad categories of "moldiness" that are of particular importance to occupants of homes. These levels and possible health implications are listed in the ARMI diagnostic chart (see Page 3).

It should be noted that there is no implicit human-health recommendation with an ARMI score. An ARMI score should be used in conjunction with individual mold species quantifications and symptoms of home occupants to arrive at an action decision. An ARMI score is simply a guideline for determining levels of mold exposure for home occupants. As research by the US-EPA and Assured Bio Labs, LLC accumulates, interpretations of ARMI scores could change.

We have included the sums of the logs of Group 1 and 2 mold species. These are used for calculating the ARMI score. However, the sum of the logs of Group 2 molds can also be used as a general indicator. Values are also commonly low after a remediation event. Values that are high could indicate that cleaning regimes are insufficient, or that a water intrusion event was large enough to cause Group 2 molds to grow in number along with Group 1 molds.

Reporting Limits

Method Detection Limit (MDL): The American Industrial Hygiene Association defines this term in AIHA-LAP, LLC Policy Document – Module 9 as "The minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99 percent probability of being identified, qualitatively or quantitatively measured, and reported to be greater than zero."

Reporting Limit (RL): The American Industrial Hygiene Association defines this term in AIHA-LAP, LLC Policy Document – Module 9 as "The lowest concentration of analyte in a sample that can be reported with a defined, reproducible level of certainty."

Values less than one will be rounded up to one per reported unit. The reporting limit(s) and result(s) are calculated based on the sampling information (i.e. collection volume, area, mass, etc.) provided by the customer as noted on the Chain of Custody. The results apply to the sample(s) as received.

Method Detection Limits (in Spores)

Anigr – 1.662, Aochr1 – 4570, Apeni2 – 3.125, Arest – 253.8, Asydo3 – 193.6, Cglob – 17.36, Eamst – 2.460, Pvari2 – 2.588, Pchry – 7.249, Wsebi – 1.379, Aaltr – 1.470, Cclad1 – 0.09958, Cherb – 9.811

Reporting Limit Calculations

Unless otherwise stated in comments, the following equation is used to calculate the reporting limit per sample: RL = MDL/5 mg.

AMERICAN RELATIVE MOLDINESS INDEX (ARMI)

ARMI = (-1.6 to 4.2) MODERATE
Mold-exposure symptoms will vary with the individual. Some individuals exhibit a greater sensitivity to mold than others.

% U.S. HOMES (y-axis: 0, 25, 50, 75, 100)

ARMI SCORE (x-axis: -5, -1.6, 1.1, 4.2, 10, 20)
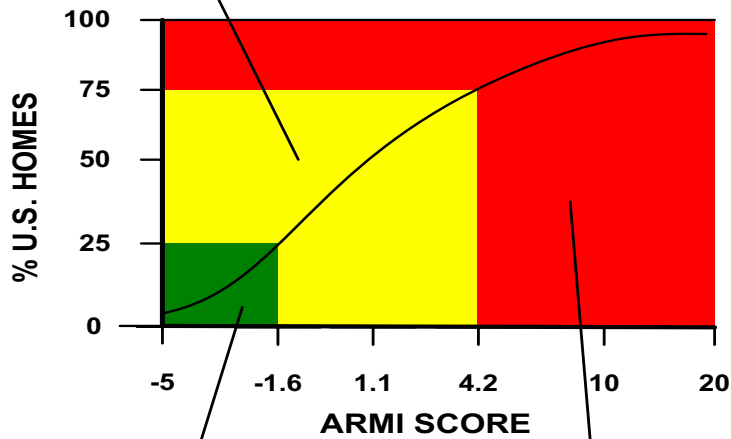
ARMI = (below -1.6) LOW
These homes hold the lowest ERMI value. Occupants of these homes are least likely to show symptoms of mold exposure. However, mold-exposure symptoms are not impossible.

ARMI = (above 4.2) High
Occupants of these homes are the most likely to show mold-exposure symptoms. However, mold-exposure symptoms are not certain. Some individuals who are least sensitive to mold may remain asymptomatic even when the ERMI score exceeds 5.

Key to ARMI Assays

Assay name	Target species / group of species
Group 1 Molds	
Anigr	*Aspergillus niger/awamori/foetidus/phoenicis*
Aochr1	*Aspergillus ochraceus/ostianus*
Apeni2	*Aspergillus penicillioides*
Arest	*Aspergillus restrictus/caesillus/conicus*
Asydo3	*Aspergillus sydowii*
Cglob	*Chaetomium globosum*
Eamst	*Eurotium (Aspergillus) amstelodami/chevalieri/herbariorum/rubrum/repens*
Pvari2	*Paecilomyces variotii*
Pchry	*Penicillium chrysogenum*
Wsebi	*Wallemia sebi*
Group 2 Molds	
Aaltr	*Alternaria alternata*
Cclad1	*Cladosporium cladosporioides* svar. 1
Cherb	*Cladosporium herbarum*

Assured Bio Identifier:	CIH011021-1		**Sample Condition:**	Intact
Sample ID:	0		**Sample Type:**	Dust
Description:	Master Bedroom and Living Room		**Sample Mass:**	5 mg

Group 1 Molds	**Spores/mg Dust**		**Group 2 Molds**	**Spores/mg Dust**
Anigr	ND		Aaltr	2
Aochr1	ND		Cclad1	119
Apeni2	1,020		Cherb	330
Arest	ND			
Asydo3	11			
Cglob	ND			
Eamst	741			
Pvari2	5			
Pchry	ND			
Wsebi	ND			

ARMI Score: 2.7