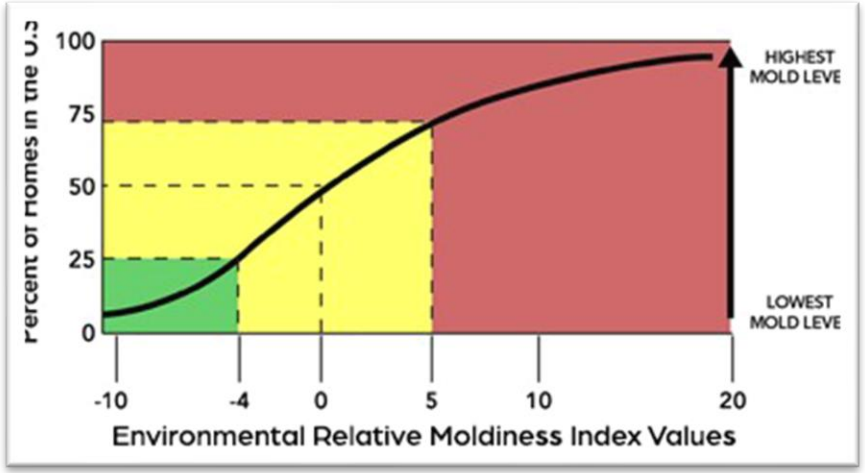
Change THE AIR FOUNDATION

Testing 101

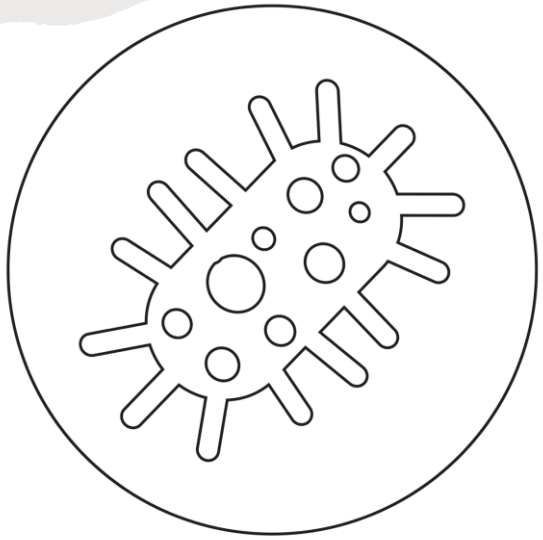
ERMI (MSQPCR) Sampling

WHAT WE WILL COVER TODAY

- DNA BASED MSQPCR TESTING
- THE ORIGINAL ERMI
- TODAY'S ERMI "LIKE" TESTING
- WHAT DOES THE ERMI TEST?
- WHERE TO COLLECT ERMI SAMPLES
- STRENGTHS
- LIMITATIONS
- WHEN TO USE AN ERMI
- READING AN ERMI
- ERMI SCORE ISSUES



DNA BASED MSQPCR TESTING

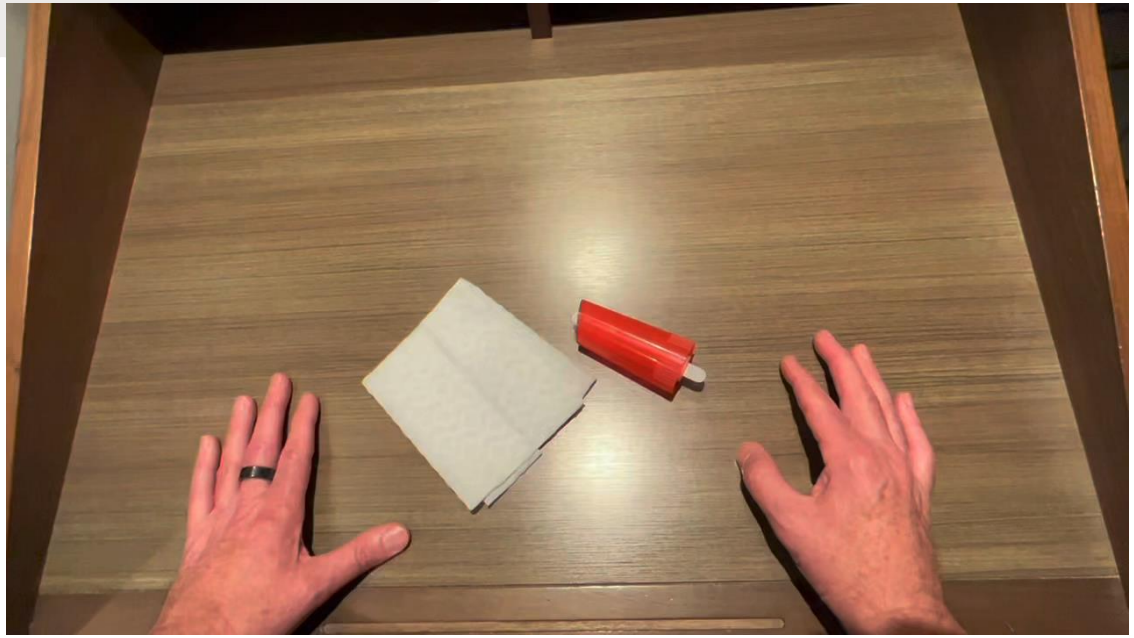


- MSQPCR is an acronym for Mold Specific Quantitative Polymerase Chain Reaction
- An ACCURATE and SENSITIVE DNA-based analytical method that identifies molds to the species level.
- It also enables us to identify the concentration levels of the species identified.
- ERMI is an example of MSQPCR testing.

THE ORIGINAL ERMI

- The Institute of Medicine's 2004 report "Damp Indoor Spaces and Health"
- EPA developed the ERMI (Environmental Relative Moldiness Index)
- Developed as a tool to evaluate
  - Potential risk of indoor mold growth.
  - Associated health effects to occupants.
- The original ERMI was a sampling methodology.
  - Used a vacuum to collect a five-minute sample in two separate rooms.
  - from a 3' x 6' area in each room.

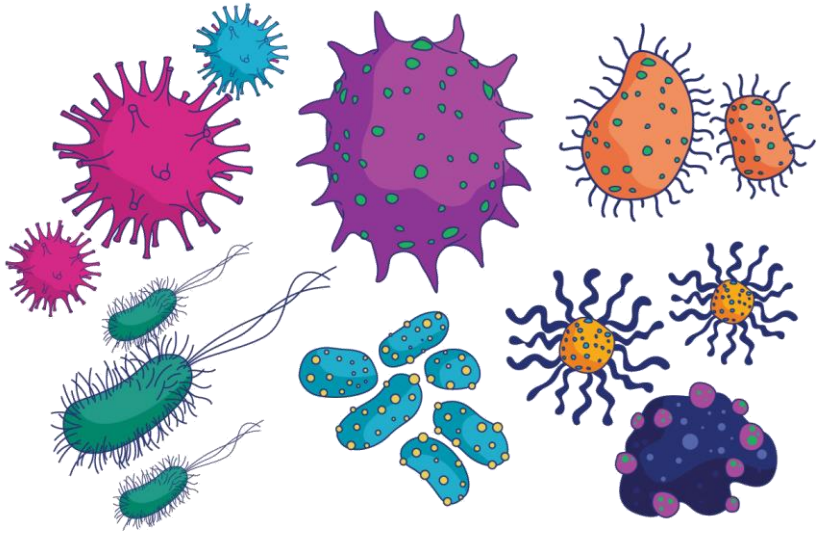
TODAY'S ERMI "LIKE" TESTING



- Today's ERMI sample is a composite of 5 mg of dust from different areas throughout the home from multiple rooms using:
  - Swiffer cloth.
  - ERMI dust cassette.
- It also provides an ERMI score like the original.

ERMI TEST PROVIDES DATA

- On 36 molds:
  - Group 1 —26 molds related to water damage
  - Group 2 — 10 molds typically found outdoor
- Secondary byproducts of mold that become source areas of contamination
  - Spores, fragments and toxins
- Showing how ultralight and small particulates:
  - Are carried in the air throughout a home.
  - Settle in dust reservoirs throughout a home.



WHEN TO USE AN ERMI

- An initial screen to determine the historical perspective of a home.
- Health related issues.
- To validate:
  - If mold is present.
  - What are you being exposed to.
  - If there are indicator molds for water damage.
- Legal cases to look at the complete picture of an impacted environment.

WHERE TO COLLECT ERMI SAMPLES

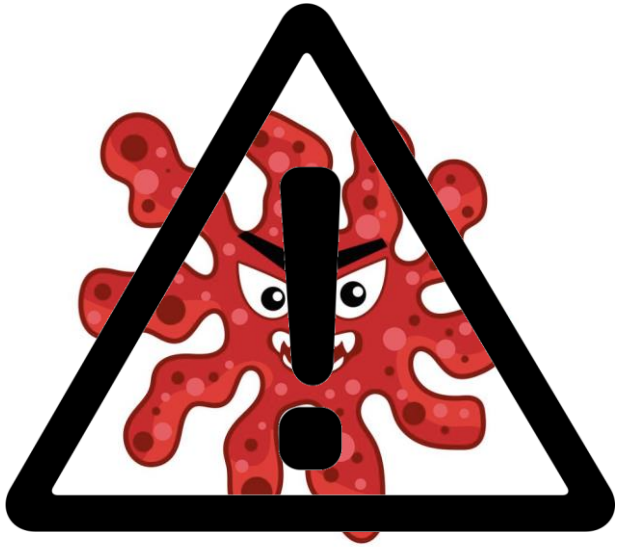
- Any area where dust collects.
- Horizontal surfaces:
  - Top of door jams.
  - Top of ceiling fans.
  - On top of appliances (TV, refrigerators).
  - Behind furniture.
  - On return vents.

STRENGTHS

- DNA formatting provides the most sensitive form for detection.
- Accurate detection of mold and species.
- Can be expedited for quick turnaround.
- Provides a historical perspective molds in the home.
- DNA lab formatting takes away concern of overloading samples so results are not overshadowed by dominate molds.

LIMITATIONS

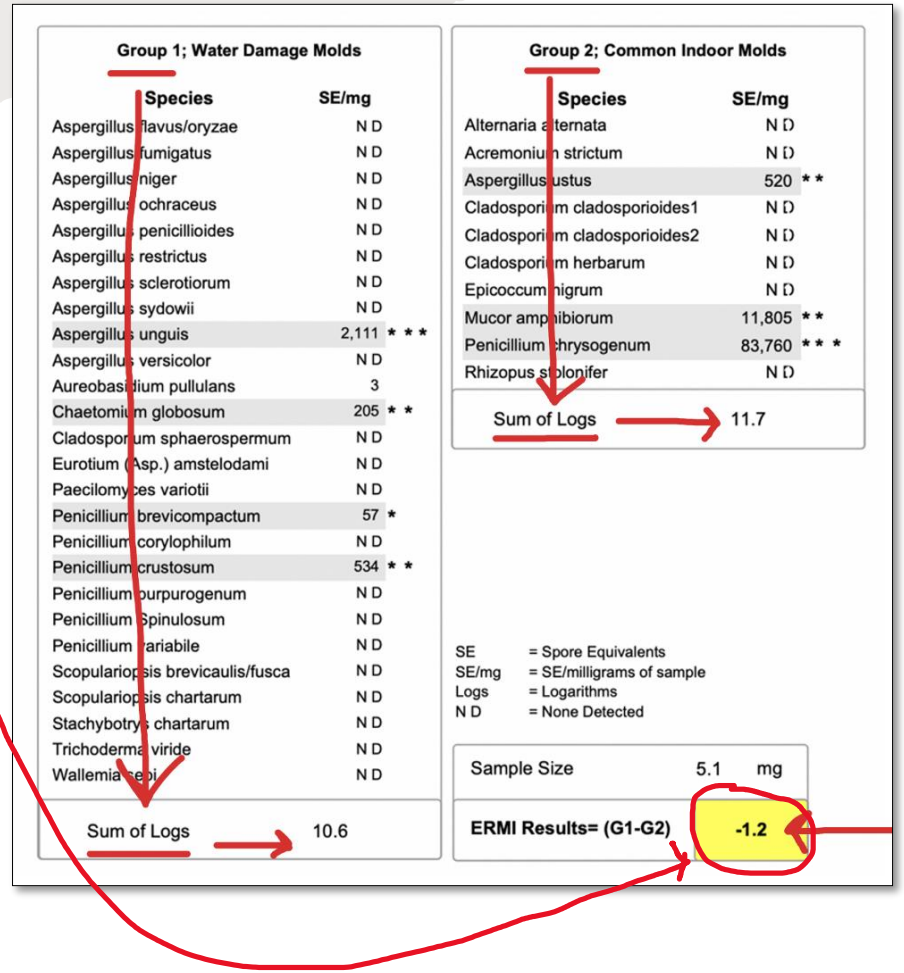
- Does not identify where the source areas are located.
- More expensive sampling method.
- Prohibitors such as drywall dust, rust and chemicals can corrupt results.
- The ERMI Score can provide a false sense of security.
  - More details on this below.



READING AN ERMI

- ERMI score is calculated by subtracting Group 1 sum of logs from Group 2 sum of logs.
- A score of 2 or less in general is the score that is advised to shoot for.
- ERMI SCORE of -1.2 indicates:
  - Low relative moldiness index
  - Further investigation not needed

Level	ERMI Values	Interpretation	Comment
Q 1	Less than - 4	Low Relative Moldiness Index	Further investigation is not needed to determine the sources of the mold.
Q 2	-4 to < 0	Low - Medium Relative	Further investigation may be needed to determine the sources of the mold if occupants have been reactive, sensitized, genetically predisposed or otherwise immuno-compromised.
Q 3	0 to < 5	Medium- High Relative	
Q 4	5 to < 20	High Relative Moldiness Index	Source and cause of mold should be determined and remediation is undertaken, reducing the ERMI to levels below Q2.
	> 20	Very High Relative	



Group 1; Water Damage Molds		
Species	SE/mg	
Aspergillus flavus/oryzae	N D	
Aspergillus fumigatus	N D	
Aspergillus niger	N D	
Aspergillus ochraceus	N D	
Aspergillus penicillioides	N D	
Aspergillus restrictus	N D	
Aspergillus sclerotiorum	N D	
Aspergillus sydowii	N D	
Aspergillus unguis	2,111	* * *
Aspergillus versicolor	N D	
Aureobasidium pullulans	3	
Chaetomium globosum	205	* *
Cladosporium sphaerospermum	N D	
Eurotium (Asp.) amstelodami	N D	
Paecilomyces variotii	N D	
Penicillium brevicompactum	57	*
Penicillium corylophilum	N D	
Penicillium crustosum	534	* *
Penicillium purpurogenum	N D	
Penicillium Spinulosum	N D	
Penicillium variabile	N D	
Scopulariopsis brevicaulis/fusca	N D	
Scopulariopsis chartarum	N D	
Stachybotrys chartarum	N D	
Trichoderma viride	N D	
Wallemia sebi	N D	
Sum of Logs	10.6	

Group 2; Common Indoor Molds		
Species	SE/mg	
Alternaria alternata	N D	
Acremonium strictum	N D	
Aspergillus ustus	520	* *
Cladosporium cladosporioides1	N D	
Cladosporium cladosporioides2	N D	
Cladosporium herbarum	N D	
Epicoccum nigrum	N D	
Mucor amphibiorum	11,805	* *
Penicillium chrysogenum	83,760	* * *
Rhizopus stolonifer	N D	
Sum of Logs	11.7	

SE = Spore Equivalents
SE/mg = SE/milligrams of sample
Logs = Logarithms
N D = None Detected

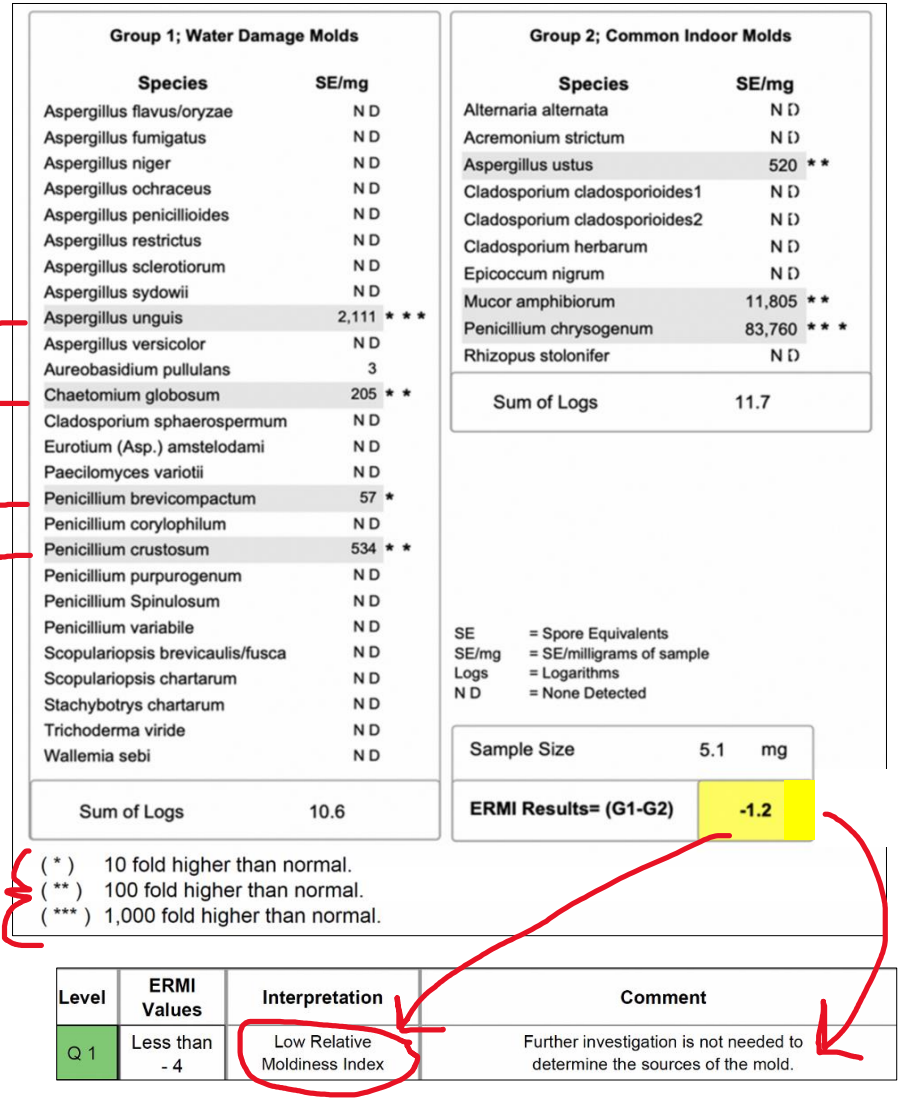
Sample Size	5.1	mg
ERMI Results= (G1-G2)	-1.2	

(10.6 – 11.7 = -**1.2**)

ERMI SCORE ISSUES

The -1.2 ERMI score in this specific report is providing a false sense of security for the following reasons:

- Group 1 Water Damage Molds
  - 4 molds were detected above average
  - 4 molds are in high concentrations.
- The asterisks denote how much higher the mold count is when compared to the average.
  - Aspergillus unguis***
    - 1,000 fold higher than normal
  - Chaetomium globosum**
    - 100 fold higher than normal
  - Penncillium brevicompactum*
    - 10 fold higher than normal
  - Penicillium crustosum**
    - 100 fold higher than normal



Group 1; Water Damage Molds

Species	SE/mg
Aspergillus flavus/oryzae	N D
Aspergillus fumigatus	N D
Aspergillus niger	N D
Aspergillus ochraceus	N D
Aspergillus penicillioides	N D
Aspergillus restrictus	N D
Aspergillus sclerotiorum	N D
Aspergillus sydowii	N D
1 Aspergillus unguis	2,111 ***
Aspergillus versicolor	N D
Aureobasidium pullulans	3
2 Chaetomium globosum	205 **
Cladosporium sphaerospermum	N D
Eurotium (Asp.) amstelodami	N D
Paecilomyces variotii	N D
3 Penicillium brevicompactum	57 *
Penicillium corylophilum	N D
4 Penicillium crustosum	534 **
Penicillium purpurogenum	N D
Penicillium Spinulosum	N D
Penicillium variabile	N D
Scopulariopsis brevicaulis/fusca	N D
Scopulariopsis chartarum	N D
Stachybotrys chartarum	N D
Trichoderma viride	N D
Wallemia sebi	N D
Sum of Logs	10.6

Group 2; Common Indoor Molds

Species	SE/mg
Alternaria alternata	N D
Acremonium strictum	N D
Aspergillus ustus	520 **
Cladosporium cladosporioides1	N D
Cladosporium cladosporioides2	N D
Cladosporium herbarum	N D
Epicoccum nigrum	N D
Mucor amphibiorum	11,805 **
Penicillium chrysogenum	83,760 ***
Rhizopus stolonifer	N D
Sum of Logs	11.7

SE = Spore Equivalents
SE/mg = SE/milligrams of sample
Logs = Logarithms
N D = None Detected

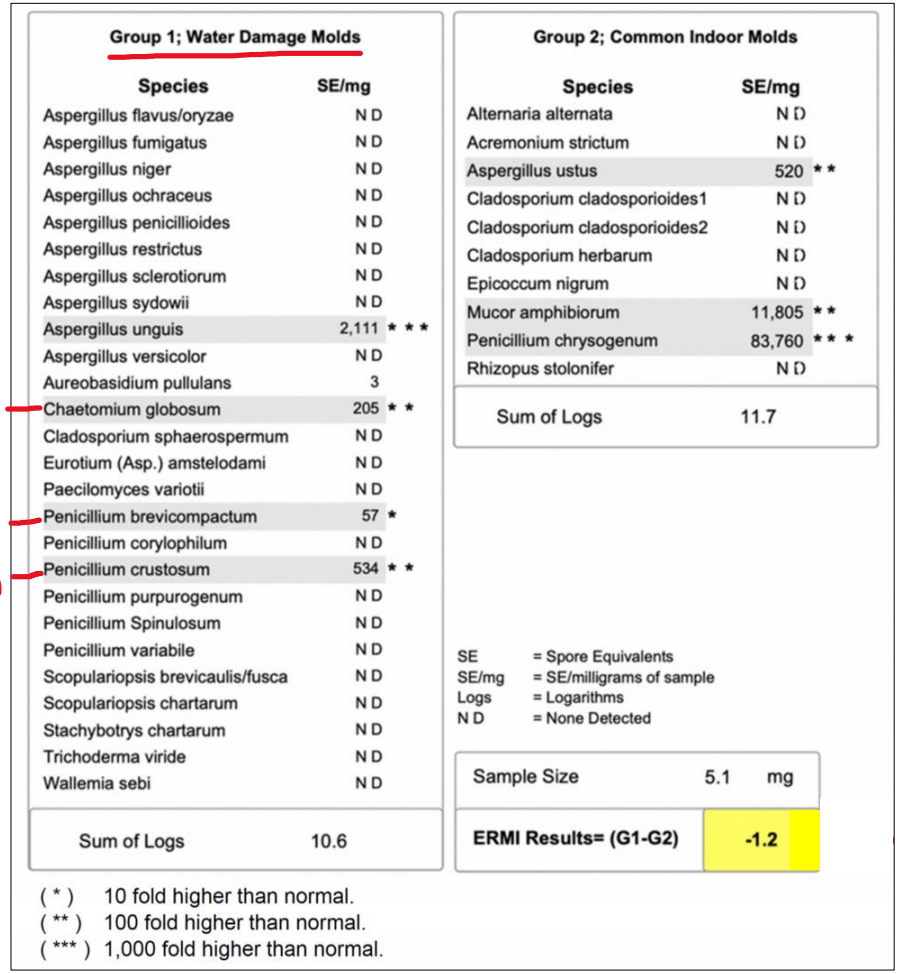
Sample Size	5.1	mg
ERMI Results= (G1-G2)	-1.2	

(*) 10 fold higher than normal.
(**) 100 fold higher than normal.
(***) 1,000 fold higher than normal.

Level	ERMI Values	Interpretation	Comment
Q 1	Less than - 4	Low Relative Moldiness Index	Further investigation is not needed to determine the sources of the mold.

ERMI SCORE ISSUES

- Three molds detected, in group 1, have the ability to produce potent mycotoxins that are harmful to both humans and animals:
  - Chaetomium globosum**
    - produces chaetoglobosins A and C.
  - Penicillium brevicompactum *
    - produces mycophenolic acid (MPA).
  - Penicillium crustosum**
    - produces potent neurotoxins.



Group 1; Water Damage Molds

	Species	SE/mg
1	Chaetomium globosum	205 * *
2	Penicillium brevicompactum	57 *
3	Penicillium crustosum	534 * *
	Aspergillus flavus/oryzae	N D
	Aspergillus fumigatus	N D
	Aspergillus niger	N D
	Aspergillus ochraceus	N D
	Aspergillus penicillioides	N D
	Aspergillus restrictus	N D
	Aspergillus sclerotiorum	N D
	Aspergillus sydowii	N D
	Aspergillus unguis	2,111 * * *
	Aspergillus versicolor	N D
	Aureobasidium pullulans	3
	Cladosporium sphaerospermum	N D
	Eurotium (Asp.) amstelodami	N D
	Paecilomyces variotii	N D
	Penicillium corylophilum	N D
	Penicillium purpurogenum	N D
	Penicillium Spinulosum	N D
	Penicillium variabile	N D
	Scopulariopsis brevicaulis/fusca	N D
	Scopulariopsis chartarum	N D
	Stachybotrys chartarum	N D
	Trichoderma viride	N D
	Wallemia sebi	N D
	Sum of Logs	10.6

Group 2; Common Indoor Molds

Species	SE/mg
Alternaria alternata	N D
Acremonium strictum	N D
Aspergillus ustus	520 * *
Cladosporium cladosporioides1	N D
Cladosporium cladosporioides2	N D
Cladosporium herbarum	N D
Epicoccum nigrum	N D
Mucor amphibiorum	11,805 * *
Penicillium chrysogenum	83,760 * * *
Rhizopus stolonifer	N D
Sum of Logs	11.7

SE = Spore Equivalents
SE/mg = SE/milligrams of sample
Logs = Logarithms
N D = None Detected

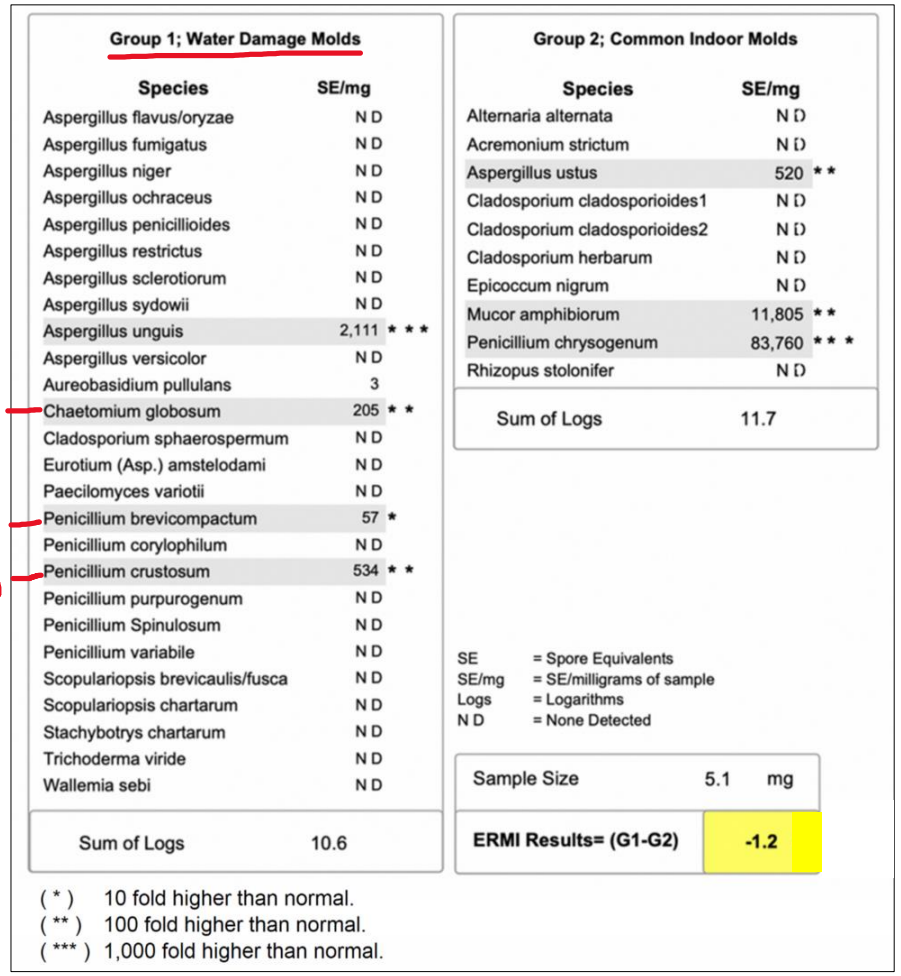
Sample Size	5.1	mg
ERMI Results= (G1-G2)	**-1.2**	

(*) 10 fold higher than normal.
(**) 100 fold higher than normal.
(***) 1,000 fold higher than normal.

Level	ERMI Values	Interpretation	Comment
Q 1	Less than - 4	Low Relative Moldiness Index	Further investigation is not needed to determine the sources of the mold.

ERMI SCORE ISSUES

- The Group 2 molds detected three common outdoor molds well above the average.
- Typically, high concentrations of outdoor molds is most often an indication of that mold growing inside the home:
  - Apergillus ustus **
    - 100 fold higher than normal.
  - Mucor amphibiorum **
    - 100 fold higher than normal.
  - Penicillium chrysogenum **
    - 100 fold higher than normal.



Group 1; Water Damage Molds

Species	SE/mg
Aspergillus flavus/oryzae	N D
Aspergillus fumigatus	N D
Aspergillus niger	N D
Aspergillus ochraceus	N D
Aspergillus penicillioides	N D
Aspergillus restrictus	N D
Aspergillus sclerotiorum	N D
Aspergillus sydowii	N D
Aspergillus unguis	2,111 ***
Aspergillus versicolor	N D
Aureobasidium pullulans	3
1 Chaetomium globosum	205 **
Cladosporium sphaerospermum	N D
Eurotium (Asp.) amstelodami	N D
Paecilomyces variotii	N D
2 Penicillium brevicompactum	57 *
Penicillium corylophilum	N D
3 Penicillium crustosum	534 **
Penicillium purpurogenum	N D
Penicillium Spinulosum	N D
Penicillium variabile	N D
Scopulariopsis brevicaulis/fusca	N D
Scopulariopsis chartarum	N D
Stachybotrys chartarum	N D
Trichoderma viride	N D
Wallemia sebi	N D
Sum of Logs	10.6

Group 2; Common Indoor Molds

Species	SE/mg
Alternaria alternata	N D
Acremonium strictum	N D
Aspergillus ustus	520 **
Cladosporium cladosporioides1	N D
Cladosporium cladosporioides2	N D
Cladosporium herbarum	N D
Epicoccum nigrum	N D
Mucor amphibiorum	11,805 **
Penicillium chrysogenum	83,760 ***
Rhizopus stolonifer	N D
Sum of Logs	11.7

SE = Spore Equivalents
SE/mg = SE/milligrams of sample
Logs = Logarithms
N D = None Detected

Sample Size	5.1	mg
ERMI Results= (G1-G2)	-1.2	

(*) 10 fold higher than normal.
(**) 100 fold higher than normal.
(***) 1,000 fold higher than normal.

Level	ERMI Values	Interpretation	Comment
Q 1	Less than - 4	Low Relative Moldiness Index	Further investigation is not needed to determine the sources of the mold.

PROPERLY USED ERMI

- When data within an ERMI report is properly used, it is a powerful and reliable tool.
- It can help flesh out mold problems that could otherwise have been missed.
- For more details please refer to article “ERMI it’s Not About the Score”.

Change THE AIR FOUNDATION

Take Action

Policy & Advocacy | Volunteer | Stay Informed | Donate

www.Changetheairfoundation.org