

Mould Sampling Alternatives

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The following are examples of different mould and water damaged building sampling techniques we use.

You don't have to be concerned as to which is your best option, because we will explain the most suitable which will fit with budget and usefulness.

These sampling techniques have benefits and shortfalls and the decision on suitability and choice will revolve around the result objectives which will vary from client to client.

We almost NEVER sample or test visible mould. It simply shouldn't be there, and it has already identified a possible health risk and should be remediated and removed. We do however specialise in identifying the invisible or hidden mould and biotoxin hazard which is probably a constant exposure source and inhalation risk.

The following lab reports are accompanied by explanation as to why the differing techniques are used.

You can see from Tables 1-3 why different forms of sampling are required

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My favourite brave couple in their 80s. They couldn't enter their home after a leak from the flat above developed Bio toxin elements including toxic moulds. They had no alternative but to wear special personal protective equipment to allow them to enter their home to make important decisions.

Table 3

The harmful effects of different mycotoxins are listed below however the synergistic effects of two or more mycotoxins is currently unknown

Aflatoxin M1 (AFM1)

This is the main metabolite of aflatoxin B1, which is a mycotoxin produced by the mould species *Aspergillus*. Aflatoxins are some of the most carcinogenic substances in the environment. Aflatoxin can lead to liver damage, cancer, mental impairment, abdominal pain, hemorrhaging, coma, and death.

Ochratoxin A

(OTA) is a nephrotoxic, immunotoxic, and carcinogenic mycotoxin. Exposure to OTA can also come from inhalation exposure in water-damaged buildings. OTA can lead to kidney disease and adverse neurological effects.

Sterigmatocystin

(STC) is a mycotoxin that is closely related to aflatoxin. STC is produced from several species of mould such as *Aspergillus*, *Penicillium*, and *Bipolaris*. STC is considered to be carcinogenic, particularly in the cells of the GI tract and liver. STC has been found in the dust from damp carpets.

Zearalenone

(ZEA) is mycotoxin that is produced by the mould species *Fusarium*, and has been shown to be hepatotoxic, haematotoxic, immunotoxic, and genotoxic.

Roridin E

(ROE) is a macrocyclic trichothecene produced by the mould species *Fusarium*, *Myrothecium*, and *Stachybotrys* (i.e. black mold). Trichothecenes are frequently found in buildings with water damage. Trichothecenes are considered extremely toxic and have been used as biological warfare agents. Even low levels of exposure to macrocyclic trichothecenes can cause severe neurological damage, immunosuppression, endocrine disruption, cardiovascular problems, and gastrointestinal distress

Verrucarin A

(VRA) is a macrocyclic trichothecene mycotoxin produced from *Stachybotrys*, *Fusarium*, and *Myrothecium*. Trichothecenes are frequently found in buildings with water damage but can also be found in contaminated grain

Testing cavity walls, usually after builders have painted over mould

In this brand-new building, mould developed on walls even before painted. The client asked to test cavities and recommend correct protocols. The cavity was completely contaminated, and all walls had to be removed back to framing

Sample type 1**QPCR--DNA airborne**

In this sample type we sample airborne particles of mould and fragments to identify DNA of spores and hyphae. This can assist in the identification of mycotoxin produces

Sample ID: 5 **Collection Volume:** 150 L
Sample Description: Chris S **Reporting Limit:** 7 Spores/Cubic Meter

Species Identification	Spores/m³ of Air Inside	Relative Abundance (%) of Detected Species
<i>Acremonium strictum</i>	ND	0.00
<i>Alternaria alternata</i>	ND	0.00
Anigr*	ND	0.00
<i>Aspergillus flavus/oryzae</i>	2,301	82.98
<i>Aspergillus fumigatus, Neosartorya fischeri</i>	ND	0.00
<i>Aspergillus ochraceus/cstianus</i>	ND	0.00
<i>Aspergillus penicillioides</i>	ND	0.00
<i>Aspergillus restrictus/caesillus/conicus</i>	ND	0.00
<i>Aspergillus sclerotiorum</i>	ND	0.00
<i>Aspergillus sydowii</i>	ND	0.00
<i>Aspergillus unguis</i>	ND	0.00
<i>Aspergillus ustus</i>	ND	0.00
<i>Aspergillus versicolor</i>	ND	0.00
<i>Aureobasidium pullulans</i>	7	0.25
<i>Chaetomium globosum</i>	ND	0.00
<i>Cladosporium cladosporioides</i> svar. 1	7	0.25
<i>Cladosporium cladosporioides</i> svar. 2	ND	0.00
<i>Cladosporium herbarum</i>	ND	0.00
<i>Cladosporium sphaerospermum</i>	ND	0.00
Eamst*	ND	0.00
<i>Epicoccum nigrum</i>	ND	0.00
Muc1*	ND	0.00
<i>Paecilomyces variotii</i>	ND	0.00
PenGrp2*	35	1.26
<i>Penicillium brevicompactum/stoloniferum</i>	ND	0.00
<i>Penicillium chrysogenum</i>	ND	0.00
<i>Penicillium corylophilum</i>	ND	0.00
<i>Penicillium purpurogenum</i>	ND	0.00
<i>Penicillium variable</i>	ND	0.00
Pspin2*	ND	0.00
<i>Rhizopus stolonifer</i>	ND	0.00
<i>Scopulariopsis brevicaulis/fusca</i>	ND	0.00
<i>Scopulariopsis chartarum</i>	ND	0.00
<i>Stachybotrys chartarum</i>	ND	0.00
<i>Trichoderma vinde/atroviride/koningii</i>	423	15.25
<i>Wallemia sebi</i>	ND	0.00
Total Spores:	2,773	

Sample 2 Airborne Genus sampling

This sampling is for airborne spore counts. It helps us identify risk and hazard areas. We usually undertake 4 samples including one outside for comparison or control purposes. This is not precise but is reasonably priced tool used internationally as a base line.

Location:	1: Outside				2: Bedroom				3: Lounge				4: Bathroom			
Comments (see below)	None				A				None				None			
Lab ID-Version†:	10483128-1				10483129-1				10483130-1				10483131-1			
Analysis Date:	07/17/2019				07/17/2019				07/17/2019				07/17/2019			
Sample volume (liters)	30				30				30				30			
Background debris (1-4*)††	1+				2+				3+				4+			
	rew ct.	Count/m3	DL/m3*	%	rew ct.	Count/m3	DL/m3*	%	rew ct.	Count/m3	DL/m3*	%	rew ct.	Count/m3	DL/m3*	%
Hypobal fragments	3	100	33	n/a					9	300	33	n/a	15	500	33	n/a
Pollen	1	33	33	n/a	3	100	33	n/a	3	100	33	n/a	15	500	33	n/a
§ TOTAL FUNGAL SPORES	17	1,900	n/a	100	284	110,000	n/a	100	172	180,000	n/a	100	213	230,000	n/a	100
Alternaria	1	33	33	2					1	33	33	<1	1	33	33	<1
Asco spores	1	130	130	7	2	270	130	<1	5	670	130	<1	2	270	130	<1
Basidiospores	4	530	130	29	1	130	130	<1	2	270	130	<1	3	400	130	<1
Chaetomium					1	33	33	<1	12	400	33	<1	18	600	33	<1
Cladosporium	8	1,100	130	57	7	930	130	1	13	1,700	130	1	12	1,600	130	1
Epicoccum													1	33	33	<1
Other brown									1	33	33	<1	1	33	33	<1
Penicillium/Aspergillus types					272	110,000	390	99	135	180,000	1,300	98	172	230,000	1,300	99
Polytrichum	2	67	33	4												
Rusts	1	33	33	2					1	33	33	<1				
Smuts, Periconia, Myxomycetes					1	33	33	<1	2	67	33	<1	3	100	33	<1
Stachybotrys																
Zygomycetes																

Sample 3

Airborne sampling of genus with a mould score against other areas for comparison. This is a pure calculation and report on comparison of air sampling against other areas. This is free when used with some tests

Fungi Identified	Indoor sample spores/m3				Raw count	Spores/m3	MoldSCORE †			
	<100	1K	10K	>100K			100	200	300	Score
Generally able to grow indoors *										
Alternaria					ND	< 33				100
Bipolaris/Drechslera group					ND	< 33				100
Chaetomium					ND	< 33				100
Cladosporium					22	2,900				214
Curvularia					ND	< 33				100
Nigrospora					ND	< 33				100
Penicillium/Aspergillus types†					91	30,000				300
Stachybotrys					ND	< 33				100
Torula					ND	< 33				100
Seldom found growing indoors **										
Asco spores					1	130				100
Basidiospores					1	130				100
Rusts					2	67				127
Smuts, Periconia, Myxomycetes					ND	< 33				100
Total						33,600				Final MoldSCORE 300

Sample 4

Sampling of settled dust fragments, spores and Hyphae to identify species and potential mycotoxin producers. Note referred to as ERMI but we analyse species and risk/hazard factors as the ERMI score has no health hazard relationship.

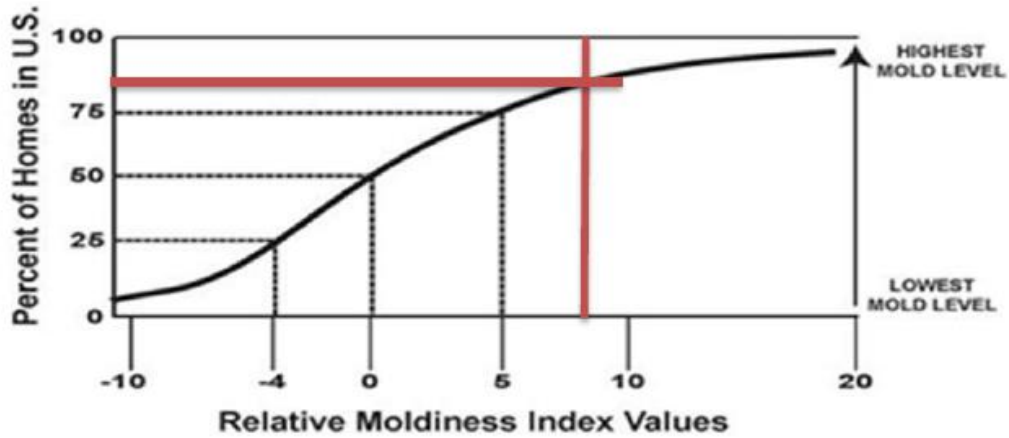
Group 1; Water Damage Molds		Group 2; Common Indoor Molds	
Species	SE/mg	Species	SE/mg
Aspergillus flavus/oryzae	4	Alternaria alternata	3
Aspergillus fumigatus	45	Acremonium strictum	27
Aspergillus niger	11	Aspergillus ustus	48
Aspergillus ochraceus	ND	Cladosporium cladosporioides1	1,336
Aspergillus penicillioides	18	Cladosporium cladosporioides2	52
Aspergillus restrictus	10	Cladosporium herbarum	1,081
Aspergillus sclerotiorum	ND	Epicoccum nigrum	954
Aspergillus sydowii	ND	Mucor amphibiorum	44
Aspergillus unguis	ND	Penicillium chrysogenum	26
Aspergillus versicolor	116	Rhizopus stolonifer	ND
Aureobasidium pullulans	1,764		
Chaetomium globosum	3	Sum of Logs	17.4
Cladosporium sphaerospermum	4		
Eurotium (Asp.) amstelodami	597		
Paecilomyces varictii	ND		
Penicillium brevicompactum	203		
Penicillium corylophilum	42		
Penicillium crustosum	43		
Penicillium purpurogenum	ND		
Penicillium Spinulosum	24		
Penicillium variabile	ND		
Scopulariopsis brevicaulis/fusca	3		
Scopulariopsis chartarum	3		
Stachybotrys chartarum	ND		
Trichoderma viride	32		
Wallemia sebi	11		
Sum of Logs	25.2		

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

Sample Size	5.0	mg
ERMI Results= (G1-G2)	7.8	

Environmental Relative Moldiness Index (ERMI) **7.8**

Interpretation **Q4**



Sampling 5

In this report we calculate the risk and hazard specifically for CIRS sufferers, (Mould illness) Chronic inflammatory Response. The risk levels are supported by research from over 1000 patient reports.

Species	Spore E./mg	Weighting
Aspergillus penicillioides	18	4
Aspergillus versicolor	116	6
Chaetomium globosum	3	0
Stachybotrys chartarum	ND	0
Wallemia sebi	11	0
HERTSMI-2 Score =		10

Colour coded interpretation	
If 10 or below	In only 17% of cases, re-occupancy of building following mould remediation has led to relapse of CIRS or WDB symptoms
If between 11 to 15	Borderline further remediation and assessment may be required
If greater than 15	Re occupation is ill advised until further remediation and re assessment are conclusive

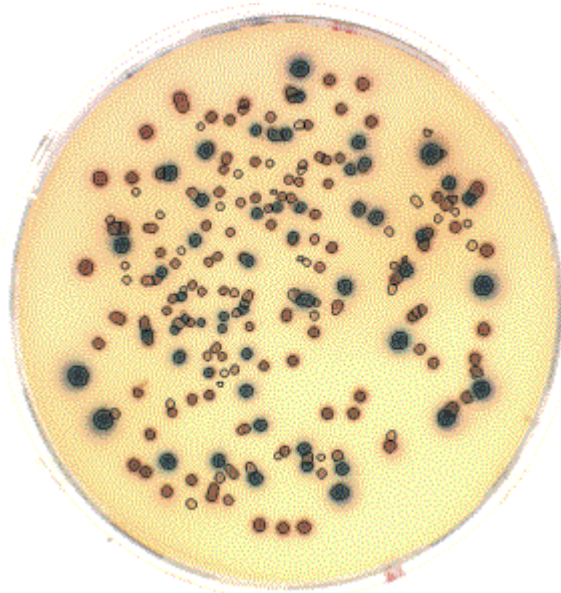
Sampling technique 8

The World Health Organization (WHO) state this form of sampling has serious limitations.

Some companies report on Colony Forming Units (CFUs) but this provides almost no useful information and can be extremely misleading.

A major issue is that CFUs are obviously only reporting on spores that grow on that specific agar within ten days. Many moulds take weeks to grow and some require different agars too. Of course, fragments of spores, hyphae and dormant spores cannot grow and according to WHO these particles are possibly 40 times more hazardous due to size and inhalation into lower respiratory system directly into blood stream.

We do NOT undertake this form of sampling or analysis as it provides no useful information to our clients. When British Standards on this type of sampling are followed the lab fees alone can be three or four times as costly as some of the techniques, we use



We Do not use these “seriously limited” (WHO) sampling protocols of swabs or culture based sampling (CFUs). The results cannot be used for health risk or hazard assessments

Bacteria testing

Mould is only one of the contaminants likely to lead to building related illness (CIRS etc) New research shows certain types of bacteria can have even more impact than mould. We can now include this additional testing for those with specialist doctors who will recognise the significance.

Gram Positive testing

Table 1 Summary of total bacteria's species		
Bacteria	Types	
Totals	511	Box 1
Pathogen	56	
Actinomycetales		
Actinomycetales	Types	
Totals	154	Box 2
Pathogenic	18	
Selected actinomycetales found in water damaged buildings		
Mycobacteria	Types	
Totals	2	Box 3
Pathogenic	0	
Streptomyces		
Streptomyces	Types	
Totals	4	Box 4
Pathogenic	0	
Non Actinomycetales		
Non Actinomycetales	Types	
Totals	357	Box 4
Pathogenic	38	

The report has a score of 19 out of 40 water damage species and is a health hazard

Color-coded interpretation	
If 9 or below	Indicative of a Healthy Building
If between 10 to 15	Further investigation needed
If greater than 15	Suggestive of Building Related Illness.

Table 2 **Summary of bacteria's Order**

Orders Detected	Abundance BE/mg	Families	Abundance	Diversity	Pathogenic
Actinomycetales	1,802,371	31	27.4 %	23.5 %	21
Bacillales	636,429	8	9.7 %	6.1 %	11
Pseudomonadales	611,179	2	9.3 %	1.5 %	14
Spirillogonadales	555,092	2	8.4 %	1.5 %	1
Rhodobacterales	518,664	1	7.9 %	0.8 %	0
Rhizobiales	439,037	11	6.7 %	8.3 %	2
Stigmatellales	268,735	1	4.1 %	0.8 %	0
Noctobales	216,885	2	3.3 %	1.5 %	0
Burkholderiales	215,014	4	3.3 %	3.0 %	3
Spirillogobacterales	170,499	3	2.6 %	2.3 %	1

Gram Negative testing

There is an elevated presence of gram-negative bacteria which is a single or synergistic health hazard

Reference Number	Date Sampled	Locations	Result EU/mg
193836-3	Jun 24, 2019	Not Given	203